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Skeptical Inquirer

THE MAGAZINE FOR SCIENCE AND REASON

Vol. 46, No. 2 | March/April 2022

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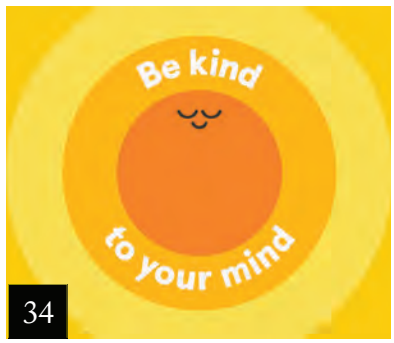

Committee for Skeptical Inquiry
"… promotes scientific inquiry, critical investigation, and the use of reason in examining controversial and extraordinary claims."

[FROM THE EDITOR

Floating in a Sea of Misinformation

We are all afloat in a sea of misinformation. Some are drowning. In our cover article, Melanie Trecek-King throws us a life preserver. A community college biology professor, Trecek-King follows up on her previous SI article, "Teach Skills, Not Facts" (January/February 2022), with a guide to evaluating claims and keeping us afloat. It is short, clear, and readable. This is the type of article on scientific skepticism that takes a step back from examining specific claims to focus on key essentials useful in examining all claims. (Her article in turn is her update of a valuable 1990 Skeptical Inquirer article, whose author, James Lett, she generously credits.) She devises a new acronym, FLOATER, to help us remember seven key tools in a toolkit to protect ourselves (and her students) from drowning in a sea of bad claims: Falsifiability, Logic, Objectivity, Alternative explanations, Tentative conclusions, Evidence, and Replicability. She discusses subcomponents of each and clearly explains why each is powerful and effective if deployed properly.

Our authors have been examining extraordinary claims and writing about critical thinking for a long time. Many articles have discussed or employed some of the guidelines that Trecek-King talks about. But I find it valuable to have all of them put together in one handy, well-organized, up-to-date package. I hope you do too.

I realize our philosopher friends find fault with at least two things she talks about: falsifiability (which they find imperfect and old-fashioned) and pointing out common logical fallacies (such as "appeal to emotions"; she lists thirteen). Yes, these aren't decisive delineators; nevertheless, I think they are useful tools, when used properly, and I think most skeptics agree.

* * *

Often when confronted with a new danger we cannot fathom, we dismiss and denigrate, ignore and equivocate. *Don't Look Up*, released in December 2021, is a hilarious (if dark) spoof and parody on the times we live in. The movie hit home to physicist and CSI Fellow Mark Boslough, whose field it depicts and who is among those who have campaigned for realistic Hollywood portrayals of scientists. He comments on it in this issue. One of the movie's strengths is the portrayal of the two main astronomers by Leonardo DiCaprio and Jennifer Lawrence. Boslough talked to the film's astronomy tech advisor, his friend Prof. Amy Mainzer, who says she helped coach the two actors on how to make the scientists authentic. It shows. These may be the best movie portrayals of scientists since Jody Foster in *Contact*.

From its launch on Christmas morning to the opening of its eighteen complex hexagonal mirrors on January 8 to its insertion into orbit around the sun at the L2 point nearly a million miles from Earth, the James Webb Space Telescope has given humanity an exciting gift to open 2022. It is hard for science-minded people not to feel joy and exuberance. The history of science tells us that advanced new observational tools transform our understanding. Congratulations to the international team of engineers, technicians, scientists, and managers who have made the Webb Telescope possible.

—Kendrick Frazier

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CFI Mission: The Center for Inquiry strives to foster a secular society based on reason, science, freedom of inquiry, and humanist values.
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Our Values: Integrity, Courage, Innovation, Empathy, Learning, and Wonder.

Is the COVID-19 Pandemic Encouraging Trust in Science and Scientists?

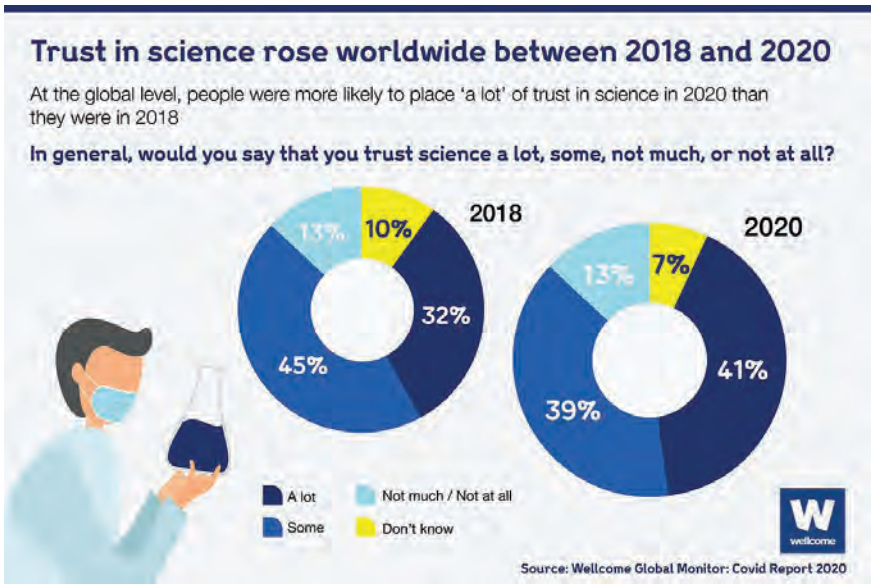
Glenn Branch

The public's trust in science and scientists is on the rise, both around the world and in the United States, according to a pair of multinational surveys. The importance of science and scientists in combatting the COVID-19 pandemic appears to be a plausible explanation.

The 3M State of Science Index conducted surveys in fall 2019 and summer 2020. In the fall 2019 survey, 85 percent of respondents somewhat (60 percent) or completely (25 percent) agreed that they trust *science*, and 80 percent of respondents somewhat (61 percent) or completely (19 percent) agreed that they trust *scientists*. In the summer 2020 survey, 90 percent of respondents somewhat (61 percent) or completely (29 percent) agreed that they trust science, and 86 percent of respondents somewhat (63 percent) or completely (23 percent) agreed that they trust scientists. (These data are for the eleven countries represented in both surveys.)

The same increase in trust was evident, but not as substantial, in the United States in particular. In the fall 2019 3M survey, 86 percent of U.S. respondents somewhat (57 percent) or completely (29 percent) agreed that they trust science, and 83 percent of U.S. respondents somewhat (60 percent) or completely (23 percent) agreed that they trust scientists. In the summer 2020 survey, 88 percent of U.S. respondents somewhat (52 percent) or completely (36 percent) agreed that they trust science, and 84 percent of U.S. respondents somewhat (54 percent) or completely (30 percent) agreed that they trust scientists. The rises in complete agreement, though not the rises in overall agreement, are statistically significant.

Wellcome Global Monitor conducted a survey throughout 2018 (discussed in the September/October 2019 SI) and again in late 2020 and early 2021. In the 2018 survey, 76 percent of respondents agreed that they trusted science a lot (32 percent) or some (45 percent), and 74 percent of respondents agreed that they trusted scientists in their country a lot (34 percent) or some (41 percent). In the 2020–2021 survey, 80 percent of respondents agreed that they trusted science a lot (41 percent) or some (39 percent), and 76 percent of respondents agreed that they trusted scientists in their country a lot (43 percent) or some (34 percent). (These data are for the 113 countries represented in both surveys; sums are not exact due to rounding.)


Trust in science rose worldwide between 2018 and 2020
At the global level, people were more likely to place 'a lot' of trust in science in 2020 than they were in 2018
In general, would you say that you trust science a lot, some, not much, or not at all?
2018
13%
10%
32%
45%
2020
13%
7%
41%
39%
A lot
Some
Not much / Not at all
Don't know
wellcome
Source: Wellcome Global Monitor: Covid Report 2020

As with the 3M surveys, the Wellcome surveys showed a similar but not as substantial increase in the United States in particular. In the 2018 Wellcome survey, 88 percent of U.S. respondents trusted science a lot (51 percent) or some (37 percent), and 86 percent of U.S. respondents trusted scientists a lot (43 percent) or some (43 percent). In the 2020–2021 survey, 89 percent of U.S. respondents trusted science a lot (55 percent) or some (34 percent), and 90 percent of U.S. respondents trusted scientists a lot (54 percent) or some (36 percent). The rises in a lot of trust, though not the rises in overall trust, are statistically significant.

In each pair of surveys, the earlier survey was conducted before the COVID-19 pandemic began and the later survey was conducted after. The organizations sponsoring these surveys both drew the obvious conclusion, with the 3M State of Science Index observing, "Against the backdrop of COVID-19 … trust in science climbed to 89%, the highest since the State of Science Index began," and the Wellcome Global Monitor remarking, "Increased exposure to science and scientists as a result of the pandemic may have influenced public opinion in many countries. Globally, people were more likely to express a high degree of trust in science and scientists in 2020 than they were in 2018."

What remains to be seen, of course, is to what extent these increases in the public trust in science and scientists will endure, both in the short term as the world continues to struggle with the COVID-19 pandemic and in the long term when, hopefully, it is a fading memory. ■

Glenn Branch is the deputy director of the National Center for Science Education and a newly elected fellow of the Committee for Skeptical Inquiry.

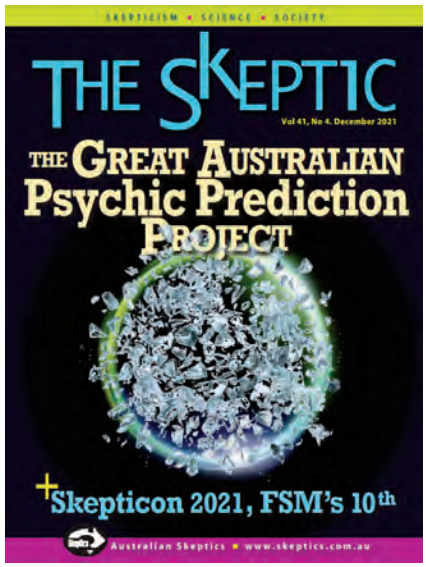
Twelve-Year Australian Skeptics Study Proves Psychics Fail … Again and Again and Again

Rob Palmer provides a personal insider report on the Great Australian Psychic Predictions Project, see Special Report, this issue (pp. 14–16).

The results of the Great Australian Psychic Prediction Project, a twelve-year study by Australian Skeptics, have revealed that so-called psychics' predictions are right only 11 percent of the time.

And when something momentous or infamous happens, they are unlikely to have foreseen it. In fact, most of what happened was not predicted, and most of what was predicted did not happen. (The Queen did not abdicate in 2003, 2004, 2012, or in 2020; anti-gravity did not become a reality; Prince Harry did not become king; and COVID-19 did not just "go away" by December 2020.)

Under the supervision of Australian Skeptics' chief investigator Richard Saunders, the survey covered over



3,800 predictions made between 2000 and 2020 by more than 200 Australian psychics. It took twelve years of diligent work by skeptics, trawling through magazines, newspapers, TV and radio, websites, YouTube, and social media, to compile as comprehensive a list of predictions as possible.

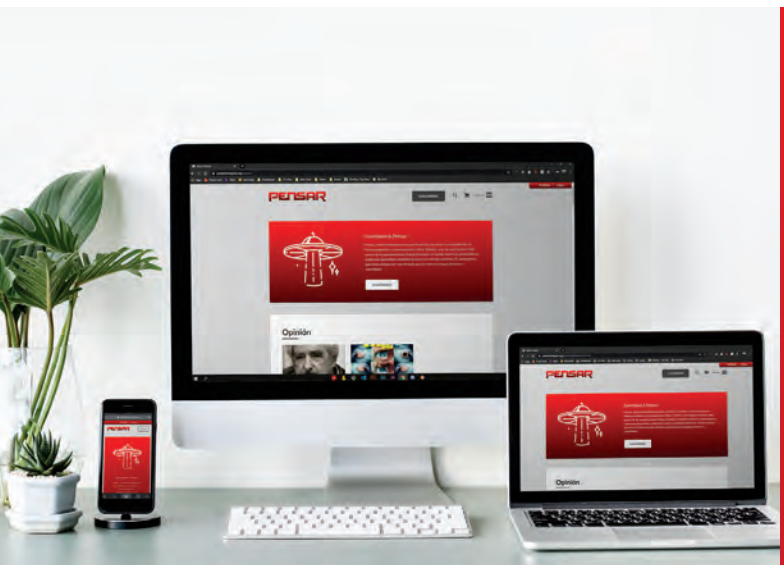
It is easily the most detailed project of its kind ever attempted in Australia and most likely the world. And the results:

- 11 percent of predictions are "correct"
- 15 percent are expected (as in, stating "the bleeding obvious")
- 19 percent are too vague
- 2 percent are unknown
- 53 percent are wrong

Tim Mendham, executive officer of Australian Skeptics, said:

> If my car mechanic was right only 11 percent of the time, I'd get a different car mechanic. But if, overall, all mechanics were right only 11 percent of the time, I'd think there was something seriously wrong with the entire industry. The results indicate nothing better than educated guessing—or even uneducated guessing—and certainly no better than any non-psychic could do, and probably a lot worse.

The full report on the survey was published in the latest issue of Australian Skeptics' magazine, *The Skeptic*, Vol. 41, no. 4, December 2021, and online on the Australian Skeptics' website, https://www.skeptics.com.au/. ■



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Committee for Skeptical Inquiry Elects 14 New Fellows from Six Countries

The Committee for Skeptical Inquiry (CSI) is pleased to announce the election of fourteen new fellows to the Committee, chosen for their outstanding contributions to science and skepticism.

This year's electees are from the United Kingdom, Ireland, Argentina, Germany, and Australia, as well as the United States. Their fields include physics, psychology, biology, and medicine. Other fellows are investigators, writers, editors, and educators. There is even a skeptic mentalist.

Nomination and election as a CSI fellow are based upon the following criteria, established by CSI's Executive Council:

1. The person has made an outstanding contribution to a scientific discipline, preferably, though not restricted to, a field related to the skeptical movement;
2. The person has made an outstanding contribution to the communication of science and/or critical thinking; or
3. The person has made an outstanding contribution to the skeptical movement.

The mission of CSI, a program of the Center for Inquiry (CFI), is to promote scientific inquiry, critical investigation, and the use of reason in examining controversial and extraordinary claims. CSI and CFI together publish the Skeptical Inquirer. Fellows of CSI serve as ambassadors of science and skepticism and may be consulted on issues related to their area of expertise by the media or by CSI. They may be asked to support statements issued by CSI and contribute commentary or articles to CSI outlets.

Founding members of CSI include noted scientists, academics, and science communicators such as Carl Sagan, Isaac Asimov, Philip J. Klass, Paul Kurtz, Ray Hyman, James Randi, Martin Gardner, Sidney Hook, and others. Current fellows include Richard Dawkins, Daniel Dennett, Elizabeth Loftus, Michael E. Mann, Bill Nye, Neil deGrasse Tyson, Eugenie Scott, Jill Tarter, and Richard Wiseman. A full list of CSI fellows is published in every issue of Skeptical Inquirer magazine and is on SI's website, skepticalinquirer.org.

Election as a fellow is a lifetime appointment. However, if in the opinion of the CSI Executive Council an individual's behavior or scholarship renders that person unable to continue to qualify for the position of fellow under the criteria above—or unable to effectively fulfill the role of ambassador of science and skepticism—CSI may choose to remove them from the list of fellows.

Alejandro Borgo, journalist and writer, Buenos Aires, Argentina. Borgo is an active journalist and writer and the director of the Center for Inquiry Argentina. He is also editor of *Pensar*, CFI's newly reinstituted online Spanish-language magazine for science and reason. He has written three books about pseudoscience and critical thinking and has spoken at several international skeptic congresses and conferences. One of the founders of the Argentine Center for Research and Refutation of Pseudoscience (CAIRP), Borgo has carried out investigations into claims of parapsychology, astrology, UFOs, and other alleged phenomena. He also organized the First Ibero American Conference on Critical Thinking in Buenos Aires, Argentina (2005).

Glenn Branch, deputy director, National Center for Science Education (NCSE). At NCSE, Branch monitors and helps coordinate resistance to efforts to undermine the teaching of evolution and climate change in formal and informal science education. He also manages NCSE's survey research program. He is the author of numerous articles on evolution education and climate change education, the coeditor of *Not in Our Classrooms: Why Intelligent Design Is Wrong for Our Schools*, and a frequent writer for Skeptical Inquirer. He received the Evolution Education Award from the National Association of Biology Teachers in 2020.

Taner Edis, professor of physics, Truman State University, Kirksville, Missouri. Edis is a Turkish-American physicist and skeptic. He received his PhD from Johns Hopkins University for research in theoretical condensed-matter physics. His research in skepticism focuses on paranormal and supernatural claims and what their failures say about the nature of science. He has also written extensively on Islamic creationism. His books include *Islam Evolving, An Illusion of Harmony, Science and Nonbelief, Why Intelligent Design Fails* (coedited with Matt Young), *The Ghost in the Universe*, and most recently (November 2021) *Weirdness! What Fake Science and the Paranormal Tell Us about the Nature of Science*.

Mark Edward, mentalist, skeptic, author, Salinas, California. Edward is an American mentalist and was a resident magician at the Magic Castle for twenty-five years. Edward says he has always been a skeptic because he is a magician. In the 1970s, he researched the methods of Uri Geller and later decided to blow the whistle on the Psychic Friends Network, then a $2 billion a year industry. Edward has been outspoken about exposing celebrity psychics and their techniques. On *Penn & Teller: Bullshit!*, he demonstrated how TV psychics John Edward (no relation) and James Van Praagh persuaded people they were communicating with their dead relatives. He is author of *Psychic Blues: Confessions of a Conflicted Medium.*

Craig A. Foster, writer and professor of psychology at SUNY Cortland. Foster is interested in the development of scientifically unrealistic beliefs—pseudoscience—and has conducted research and written prolifically in that area. Topics include anti-vaccination, flat-earth belief, facilitated communication, and others. He received his doctorate in social psychology at the University of North Carolina and then joined the Department of Behavioral Sciences and Leadership at the U.S. Air Force Academy, where he continued researching and writing in several areas, including pseudoscience and scientific skepticism. His Skeptical Inquirer essays include "Respectful Skepticism" and "Skepticism, at Heart, Is Not Partisan," other commentaries and reviews, and an investigation into claims that wearing titanium-treated necklaces improves emotional well-being. He is currently the chair of the Psychology Department at SUNY Cortland.

Natalie Grams-Nobmann, medical doctor, Heidelberg, Germany. Grams-Nobmann is a medical doctor who worked in her own practice as a professional homeopath. In researching a book on homeopathy, she recognized she had been mistaken about it and realized it was a false ideology. The book she was writing (*Homeopathy Reconsidered*) became not a defense but a critical analysis. She abandoned her homeopathic private practice. She engaged with the skeptical community in Germany and now considers herself a "skeptic by profession." In 2016, she cofounded the "Information Network Homeopathy" and was communications manager of the German skeptics group GWUP. She now works in public health and continues to write articles and columns to educate people about homeopathy's failings.

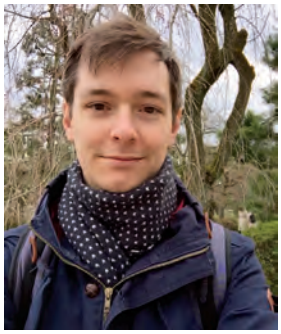
David Robert Grimes, physicist, cancer researcher, broadcaster, author, Dublin, Ireland. Born in Dublin, Grimes did his doctoral research in UV radiation physics at Dublin City University and his postdoctoral research on medical physics and oncology. He has a keen interest in the public understanding of science. He writes on science and society for outlets including *The Guardian*, *Irish Times*, the BBC, the *Spectator*, and the *Sunday Business Post*. He appears frequently in the news media on topics from the anti-vaccination movement and bogus cancer cures to climate change and conspiracy theories. He was joint recipient of the 2014 *Nature*/Sense about Science John Maddox Prize for standing up for science. His book *The Irrational Ape* has now been published in the United States as *Good Thinking: Why Flawed Logic Puts Us All at Risk and How Critical Thinking Can Save the World* (excerpted in the January/February 2022 SKEPTICAL INQUIRER).

Raymond E. Hall, professor of physics, California State University, Fresno. Hall's research focus involved a 700-member particle physics experiment at Fermilab from 1989–2010, a highlight of which included the discovery of the top quark, a fundamental particle of nature. His current research centers on understanding best practices for teaching the methods of science and the tools of critical thinking. His work at Fresno State includes teaching courses in engineering physics, quantum mechanics, critical thinking, and the philosophy of science. Hall is the organizer of the Sunday Papers session at CSICon conferences and before that was conference organizer and a director of programming for James Randi's The Amazing Meeting (TAM) conferences.

Michael Heap, clinical and forensic psychologist and lecturer (ret.), Sheffield, U.K. Heap has a PhD in psychology and has worked as a research psychologist, university lecturer, and clinical and forensic psychologist. One of his research topics was hypnosis, where he clarified misinformation promoted by the media. In 1974, Heap and colleagues established in the U.K. the Association for Skeptical Enquiry ("casting a critical eye over suspect science, dubious claims, and bizarre beliefs"), and he continues as its main organizer as well as editor of its quarterly magazine *The Skeptical Intelligencer*. He is also one of the organizers of Sheffield Skeptics in the Pub and now undertakes voluntary work as a humanist advisor and teacher.

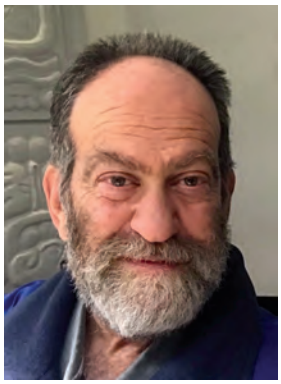
Nathan H. Lents, professor of biology, City University of New York. Lents is professor of biology at John Jay College, City University of New York, and currently director of its Cell and Molecular Biology Program. He is noted for his work in cell biology and genetics and for his popular science writing and blogging on the evolution of human biology and behavior. He is the author of *Not So Different: Finding Human Nature in Animals* and *Human Errors* (a highly readable discussion of human imperfections that are the result of evolutionary compromises). He has appeared as a scientific expert in a range of national media, including *The Today Show*, NPR, *48 Hours*, Univisión, and *Access Hollywood*.

Leighann Lord, standup comedian, author, host. A former host of the Emmy-nominated *StarTalk* podcast with Neil deGrasse Tyson, Lord has shared her comedic and hosting talents at many skeptic and atheist conferences, including CSICon, NECSS, DragonCon's Science and Skeptical tracks, Skepticon, and most recently our own biweekly webinar talks Skeptical Inquirer Presents. She has been seen on Lifetime, VH1, Comedy Central, Netflix, DryBar Comedy, HBO, and Showtime. She was the New York City face of the African Americans for Humanism campaign of the Center for Inquiry. She is author of *Real Women Do It Standing Up: Stories from the Career of a Very Funny Lady* and recipient of the 2019 Humanist Arts Award.



Michael Marshall, investigator, activist, podcaster, and editor, Liverpool, U.K. Michael "Marsh" Marshall is a British skeptical activist, freelance journalist, public speaker, podcaster, author, blogger, and, since September 2020, the editor of *The Skeptic* magazine (U.K.) He is the cofounder and president of the Merseyside Skeptics Society and cohost of its official podcast, *Skeptics with a K*; project director of the Good Thinking Society (where the major focus has been on ending British government funding of homeopathy); and has occasionally written for *The Times*, *The Guardian*, and *New Statesman*. He has carried out several notable activist campaigns, challenging psychics and engaging with believers to understand their thinking.

Tim Mendham, executive officer and editor of *The Skeptic*, Australian Skeptics, Sydney, Australia. Mendham not only heads day-to-day operations of the Australian Skeptics, but he also edits its fine quarterly magazine *The Skeptic* and writes much of each issue. He has recently written on such varied topics as Erich von Däniken (an icon of pseudoscience), a university's promotion of pseudoscience, James Randi's exploits in Australia, the false theory of gay conversion therapy, cryptozoology publications and websites, and the sovereign citizen movement. He has written about websites that promote a skeptical view of the world in general. He has also revisited classic books, ranging from Charles Mackay's *Extraordinary Popular Delusions and the Madness of Crowds* to Joe Nickell's *Inquest on the Shroud of Turin.*



Leonard Tramiel, physicist, science communicator, Palo Alto, California. Tramiel is a physicist with a passion for science and astronomy and a dedication to public understanding of science and skepticism. He is a board member of the Center for Inquiry and a member of the Executive Council of the Committee for Skeptical Inquiry. After getting his PhD in physics from Columbia University and working in the Columbia Astrophysics Lab, he joined his father at Atari as vice president of software, helping develop Atari's products. He is active in skeptical and atheist causes and also serves on the Council of Advisors for the SETI Institute. He has worked with the California Department of Education to improve the quality of science textbooks and, since 2000, has been a regular volunteer at the Chabot Space and Science Center. ■

Timothy Caulfield, Susan Gerbic Awarded Balles Prizes for Critical Thinking

Paul Fidalgo

Every year, the Committee for Skeptical Inquiry (CSI)—a program of the Center for Inquiry and publisher of the Skeptical Inquirer—honors the creators of the published work that best communicates the importance of skepticism and empirical science with the Robert P. Balles Annual Prize in Critical Thinking.

Normally, the $2,500 award is presented at the Committee's annual CSICon conference, but due to the COVID-19 pandemic, the conferences for 2020 and 2021 had to be cancelled. Therefore, the prizes for 2019 and 2020 have yet to be awarded.

Until now. Rather than wait another year, CSI is proud to announce the winners of the 2019 and 2020 Balles Prizes in Critical Thinking.

(And here's hoping we get to present the 2021 award at CSICon 2022!)

The Balles Prize for 2019 Goes to Susan Gerbic: The Psychic Stinger

We are sick of being duped.

One of the hardest lessons of the COVID-19 pandemic is that our culture is saturated with con artists, snake oil hucksters, and swindlers, all insisting they have special access to secret truths. Some claim to have knowledge of vast global conspiracies. Others promise cures and remedies to whatever ails us. And still others pretend to be able to read minds and speak to the dead.

For far too long, this last group of charlatans, so-called psychics and mediums, have enjoyed credulous coverage and precious little scrutiny of their scams. They are fawned over by talk show hosts and the victims they've fleeced. But in recent years, these "grief vampires" have met their match.

Susan Gerbic is fake psychics' worst nightmare that they never saw coming. Over the course of dozens of meticulously executed stings, tests, and exposés, Gerbic has uncovered the fraud underlying the claims of several celebrity psychics. She has assembled a team of dedicated volunteers who assist her in planning and research for elaborate and rigorous undercover operations that reveal the tricks employed by psychics and mediums.

And she has thoroughly documented all of it in the pages and on the website of Skeptical Inquirer. Her articles about her and her team's numerous stings—with whimsical code names such as Operation Pizza Roll and Operation Ice Cream Cone—are compelling accounts of skeptical investigation, digital sleuthing, and real-world spycraft, filled with slap-your-forehead moments of revelation, as well as honest appraisals of the times she and her team fell short of catching a crook in the act.

Her articles are as transparent as they are thrilling.

Gerbic's incredible work exposing the lies of the self-proclaimed "Manhattan Medium" and "Seatbelt Psychic" Thomas John caught the attention of *The New York Times*, which published a magazine profile of the escapades of Gerbic and her "group of online vigilantes" in February 2019, "Inside the Secret Sting Operations to Expose Celebrity Psychics," written by Jack Hitt.

"The world is ready for stories such as this," Gerbic wrote that year. "People are sick of reality television and lying cheats getting away without consequences." Now, in the age of COVID-19 misinformation and QAnon conspiracy madness, her words ring even more true.

Indeed, you could say her diagnosis of American attitudes toward fraudsters was prophetic! But we can't prove it. What we *can* do is award her the 2019 Balles Prize in Critical Thinking.

The Balles Prize for 2020 Goes to Timothy Caulfield: A Booster Shot for Science

From the despicable we move to the outright destructive. Our current frustration with celebrity con artists has reached a fever pitch during the COVID-19 pandemic, as snake oil profiteers have flourished, enriching themselves through the promotion of misinformation and pseudoscience.

Luckily, one mild-mannered Canadian man has been hot on these hucksters' trails the entire time. Timothy Caulfield wrote in 2020:

> I have studied the spread and impact of health misinformation for decades and have never seen the topic being taken as seriously as it is right now. Perhaps that is because of the scale of the crisis and the ubiquity of the nonsensical misinformation, including advice from some very prominent politicians. If this pro-science response is to endure, all scientists—not just a few of us—must stand up for quality information.

Caulfield earned international attention a few short years ago for calling bullpucky on the false and unscientific promises of celebrity gurus such as Gwyneth Paltrow, with her Goop empire of pseudoscience. In 2020, Caulfield's clear, accessible, and hopeful advocacy of science and evidence were invaluable for a public desperate to navigate their way through the infodemic during the pandemic. As we are overrun by invading armies of media figures wielding fake cures, half-baked treatments, retracted studies, and absurd levels of reality-denial, Caulfield has been a happy warrior for the truth.

In 2020, Caulfield partnered with Canada's Sen. Stan Kutcher to found ScienceUpFirst, a national initiative that works with a collective of independent scientists, researchers, health care experts, and science communicators. In

December of that year, Caulfield appeared on Skeptical Inquirer Presents to rally the reality-based community to his cause with a clear and simple message: Debunking works!

Caulfield understands that to have any hope of emerging from the infodemic intact, we must all be a part of the solution, not simply by ignoring false information but by flooding the zone with real, evidence-based information. This is something we can all contribute to, but he particularly calls on all scientists, researchers, and medical professionals to stop ceding ground to the liars. He wrote, "Correcting misrepresentations should be viewed as a professional responsibility."

This happy warrior is not done fighting. On any given day, you can find his byline in any number of media outlets, large and small. You can find him spreading his pro-science message on TV news, online videos, and podcasts. He is never condescending and never despairing. Instead, he shows genuine compassion for those being victimized by false information and an infectious enthusiasm for winning this war. What would we do without him?

For the pandemic, we have vaccines. For the infodemic, we have people such as Timothy Caulfield. That's why he's the winner of the 2020 Balles Prize in Critical Thinking.

* * *

The Robert P. Balles Annual Prize in Critical Thinking is an award given to the creator of the published work that best exemplifies healthy skepticism, logical analysis, or empirical science. The prize was established by Robert P. Balles, a practicing Christian, along with the Robert P. Balles Endowed Memorial Fund, a permanent endowment fund for the benefit of CSI. The winners of the 2018 Balles Prize were Blake Ellis and Melanie Hicken for their book *A Deal with the Devil: The Dark and Twisted True Story of One of the Biggest Cons in History*. ■

Paul Fidalgo is the comminications director for the Center for Inquiry.

Elisabeth Bik Wins John Maddox Prize, U.K. Skeptics Award for Exposing Science Misconduct

Kendrick Frazier

Dutch microbiologist Elisabeth Bik had quite a conclusion to 2021. For the past seven years, Bik has actively investigated questionable practices in scientific publications, and in 2019 she announced she was taking a year off work to do so full time. She is now best known for her work detecting photo manipulation in scientific papers and identifying more than 4,000 potential cases of improper research conduct. Among these instances were 400 research papers published by authors in China from a research paper mill company.

In June, the journal *Science* (372: 1021, June 4) reported that Bik had been threatened with legal action by a French researcher who has published on the benefits of "healing energy" and demanded she retract her critiques and apologize. More than 1,400 researchers signed an open letter—and more than 3,000 others signed a petition—defending Bik. The letter expressed concern that "legitimate scientific criticism can be squelched by behaviors that go beyond scholarly debate." She reported that after she blogged about her concerns about a widely publicized paper the researcher had published on the antimalarial drug hydroxychloroquine, she faced months of harassment on Twitter from the researcher and his colleagues. They published her full home address.

Earlier she identified 400 research papers published in China over a three-year period, all appearing to originate from a company that provides full-service production of articles describing fake research for medical students in China who are required to publish a paper to get their medical degree but haven't the time to do it.

(She also helped physicist and CSI Fellow Mark Boslough confirm photo manipulation in a questionable research paper he reported on in the Skeptical Inquirer, "Sodom Meteor Strike Claims Should Be Taken with a Grain of Salt," January/February 2022.)

Bik's efforts have led to retractions and corrections of published work and have inspired new standards and mechanisms for journals to screen images included in scientific papers.

She has gotten some accolades for her work (including from the Microbiology Society in 2020), but in the space of one week in December 2021, Bik was greeted with two major new honors: she was named recipient of the John Mad-

dox Prize for "outstanding work exposing widespread threats to research integrity in scientific papers," and U.K.'s *Skeptic* magazine named her recipient of its 2021 Ockham Award for Skeptical Activism.

The Maddox Prize is given annually by the journal *Nature* and the nonprofit Sense about Science to scientists deemed to have defended and explained science. It is named for former longtime *Nature* editor John Maddox, who was himself a tireless defender of research integrity and a fellow of the Committee for Skeptical Inquiry. The prize recognized Bik's work exposing image manipulation, plagiarism, data manipulation, and methodological concerns in 5,000 scientific papers.

"Science builds upon science, and science publications that contain errors or even fraudulent data should be discussed, corrected, or even retracted," Bik said. "Unfortunately, as I have experienced in the past years, being critical about scientific papers can lead to online harassment, doxing, and threats of lawsuits and jailtime."

The Skeptic's Ockham Award for skeptical activism was presented to Bik at a December 9 Skeptic's in the Pub online event. Michael Marshall, editor of *The Skeptic*, said:

> The COVID-19 pandemic has shown us that scientific integrity is more important than ever, and public trust in science is a vital part of public health. While that can mean raising up outstanding science wins like the vaccine development across the world in response to this pandemic, it can also mean identifying and acting on fraudulent, mistaken, plagiarized, or just plain bad science.
>
> Dr. Elisabeth Bik has been working on exactly this since 2013. Her effort to manually identify image manipulation and duplications in scientific publications has been unparalleled, and her contribution to critical thinking and research integrity makes her a worthy recipient of this year's Ockham Award. ■

Kendrick Frazier is the editor of the SKEPTICAL INQUIRER.

News Notes on Skeptical Matters

Our Precautionary UFO "Tips": Back in June 2021 at the height of the most recent UFO craze, we issued our "Tips for Media in Covering UFO/UAP Claims." It went out widely to the media. We also published it in our special issue "UFOs (or UAP) Hit the News," SI, September/October 2021. But it sure didn't take long for it to appear elsewhere. By early October, a new newsstand "bookazine," *The Complete Guide to Aliens and UFOs* (Centennial Media, Miami, Florida), was out and included all eight of our Committee for Skeptical Inquiry's tips. The tips were highlighted in a two-page spread (pp. 28–29), "Evaluating ET," prepared by science journalist Pamela Weintraub. "The enduring mystery of UFO reports has required we keep an open mind," the main, display-type intro began. "At the same time, we've got to bring a skeptical mindset to the news. Here's how to balance wonder with reality." Weintraub then further introduced the tips: "We'd like to arm you with a few tools for critical thinking. To help us, as journalists, and you, as readers, parse the material [about UFOs], the Committee for Skeptical Inquiry has supplied a checklist of precautions for the close encounters ahead. We would like to share them with you." Good to see the tips in print in such a book. But you won't be surprised to learn that the rest of the bookazine was noticeably less skeptical.

Natalia Pasternak's Honors Multiply: Congratulations to CSI Fellow Natalia Pasternak and Carlos Orsi. In November, they won the Brazilian National Literature Prize for the best science book of 2020 for their book *Science in Our Daily Lives*. And that was followed in December by word that the BBC has selected microbiologist and science communicator Pasternak as one of "BBC's 100 Women of 2021," a list of the 100 "inspiring and influential women from around the world." BBC's citation said: "She has brought crucial, life-saving scientific information to millions of people in Brazil during the Covid-19 pandemic, though her press columns, radio, and TV appearances." Pasternak is now working at Columbia University with the noted neuroscientist and writer Stuart Firestein.

Copperfield-Wiseman Backstory: When David Copperfield and Richard Wiseman got together for an hour on Skeptical Inquirer Presents on November 11, 2021, they had some mind-bending tales. The emphasis was on their new large-format book *David Copperfield's History of Magic* (coauthored by Wiseman). It beautifully portrays stories about many prominent magicians and their artifacts as collected in Copperfield's Museum of Magic—a secret, behind-the-scenes museum he created in Las Vegas. Wiseman revealed at the beginning that the book had its origin at a CSICon conference. Three or four years ago, Wiseman was a speaker at CSICon in Las Vegas, and he suggested to fellow skeptic Massimo Polidoro that they go see a performance down the street by Copperfield, winner of twenty-two Emmy awards for his shows. They did. Copperfield welcomed them backstage and invited them to tour his Museum of Magic the next day. Wiseman did so and was entranced by what he saw. He and Copperfield right then came up with the idea of the book. So as Wiseman said, if it hadn't been for our skeptical conference in Las Vegas, there'd have been no *David Copperfield's History of Magic.*

—KENDRICK FRAZIER

Elegy Written at a Séance Table

Joe Nickell

To James Randi

I know you'd come back
    if anyone were able,
surely nudge the planchette,
or yet
    tip the tipping table
to spell
messages at will.
    I wouldn't need
daydreaming
    to see you, maybe
streaming
    vaporized
        ectoplasm
    before my eyes,
    or otherwise
return
    despite the chasm,
        from the Other Side.
        You wouldn't hide
but somehow appear,
    to one who's been
so very, very long, sitting here.

Joe Nickell, PhD, is senior research fellow of the Committee for Skeptical Inquiry (CSI) and "Investigative Files" columnist for Skeptical Inquirer. A former stage magician, private investigator, and teacher, he is author of nearly fifty books.

The Great Australian Psychic Prediction Project

Pondering the Published Predictions of Prominent Psychics

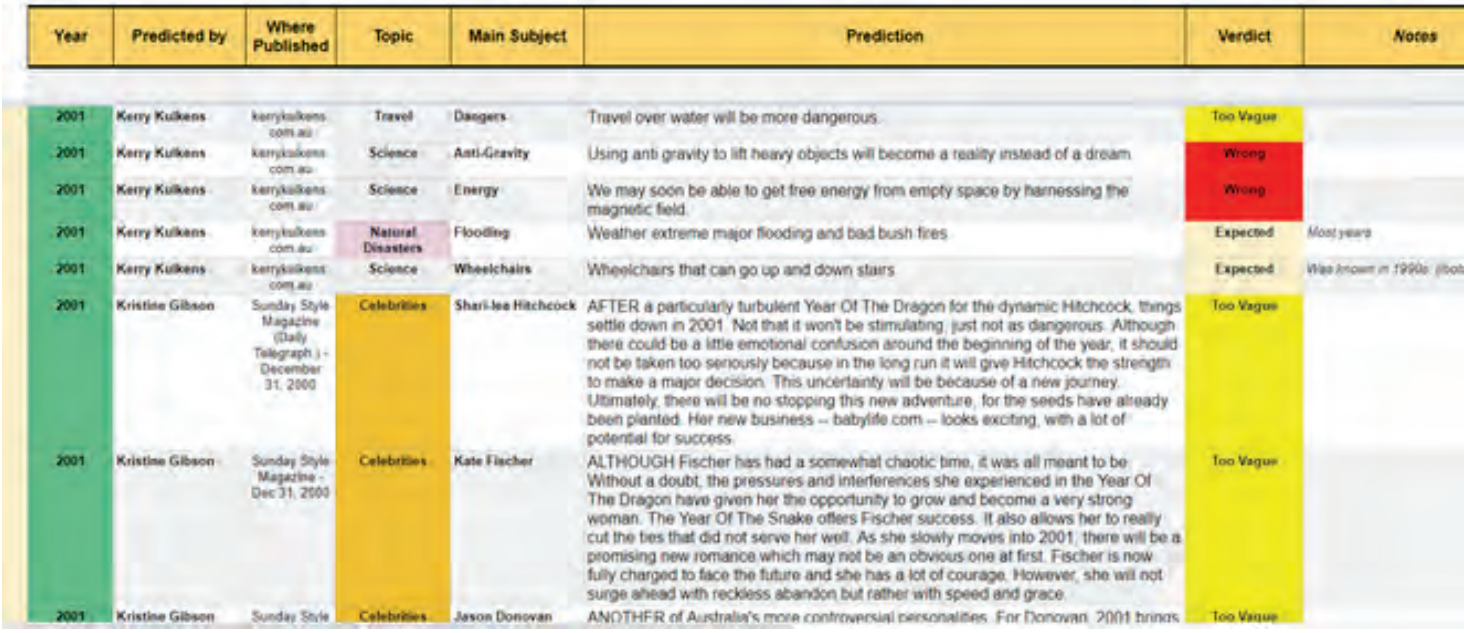
ROB PALMER

A typical scoring session held over Zoom. Top left to bottom right: Susan Gerbic, Richard Saunders, Leonard Tramiel, Louis Hillman, Kelly Burke, Adrienne Hill, Michelle Bijkersma, Rob Palmer, Dr. Angela Mattke.

When I first met CSI Fellow Richard Saunders, the producer and host of *The Skeptic Zone* podcast, at CSICon 2017, I had *no way of knowing* that in less than a year I would be writing for skepticalinquirer.org. I also had *no way of knowing* that once I had that job, my first article would be an interview with Saunders. I also had *no way of knowing* that a few years later, I'd be working with Saunders for several hours every week over the course of a year and a half as part of his twelve-year project researching Australian psychic predictions—a project that became known as the Great Australian Psychic Prediction Project (GAPPP).

Of course, if I were psychic, then I should have *had a way of knowing* all that, right? I could have easily predicted these otherwise unforeseeable events in my own future.

Or could I have? Could *anyone* have done that? Can self-proclaimed psychics predict unlikely future events with any greater accuracy than chance? That's precisely what Saunders set out to determine when he began this project over a decade ago. The project was described in the Australian Skeptics' quarterly publication, *The Skeptic*, as follows: "The Great Australian Psychic Prediction Project is an analysis of over 3800 psychic or otherwise paranormal predictions, made by 207 people in Australia claiming to have knowledge



Year	Predicted by	Where Published	Topic	Main Subject	Prediction	Verdict	Notes
2001	Kerry Kulkens	kerrykulkens.com.au	Travel	Dangers	Travel over water will be more dangerous.	Too Vague	
2001	Kerry Kulkens	kerrykulkens.com.au	Science	Anti-Gravity	Using anti gravity to lift heavy objects will become a reality instead of a dream.	Wrong	
2001	Kerry Kulkens	kerrykulkens.com.au	Science	Energy	We may soon be able to get free energy from empty space by harnessing the magnetic field.	Wrong	
2001	Kerry Kulkens	kerrykulkens.com.au	Natural Disasters	Flooding	Weather extreme major flooding and bad bush fires	Expected	Most years
2001	Kerry Kulkens	kerrykulkens.com.au	Science	Wheelchairs	Wheelchairs that can go up and down stairs	Expected	Was known in 1990s (Bost
2001	Kristine Gibson	Sunday Style Magazine (Daily Telegraph) - December 31, 2000	Celebrities	Shari-lea Hitchcock	AFTER a particularly turbulent Year Of The Dragon for the dynamic Hitchcock, things settle down in 2001. Not that it won't be stimulating, just not as dangerous. Although there could be a little emotional confusion around the beginning of the year, it should not be taken too seriously because in the long run it will give Hitchcock the strength to make a major decision. This uncertainty will be because of a new journey. Ultimately, there will be no stopping this new adventure, for the seeds have already been planted. Her new business -- babylife.com -- looks exciting, with a lot of potential for success.	Too Vague	
2001	Kristine Gibson	Sunday Style Magazine - Dec 31, 2000	Celebrities	Kate Fischer	ALTHOUGH Fischer has had a somewhat chaotic time, it was all meant to be. Without a doubt, the pressures and interferences she experienced in the Year Of The Dragon have given her the opportunity to grow and become a very strong woman. The Year Of The Snake offers Fischer success. It also allows her to really cut the ties that did not serve her well. As she slowly moves into 2001, there will be a promising new romance which may not be an obvious one at first. Fischer is now fully charged to face the future and she has a lot of courage. However, she will not surge ahead with reckless abandon but rather with speed and grace.	Too Vague	
2001	Kristine Gibson	Sunday Style	Celebrities	Jason Donovan	ANOTHER of Australia's more controversial personalities. For Donovan, 2001 brings	Too Vague	

A peek at the GAPPP database

of future events. All were published in Australian media … covering a 21-year period (2000 to 2020)."

The project's final results have now been published in *The Skeptic* (Vol. 41, no. 4, December 2021), and the results are striking. As Saunders summarized it:

> • Psychics are appallingly bad at predicting future events. Only 11 percent of predictions are "correct."
>
> • Most predictions were too vague, expected, or simply wrong.
>
> • Most of what happens is not predicted, and most of what is predicted does not happen.

I must point out that 11 percent is generous. One example demonstrating this point is our scoring for the prediction: "Australian cricket team does very well on tour this year" (Heather Alexander, 2009). We scored that as correct—but clearly there was a 50/50 chance: the team would either do well or they would not. If every prediction was like that, the average for correct psychic predictions would have been 50 percent. The more of those types of predictions that psychics make, the closer to 50 percent correct their average will get. And they make a lot of those.

There are also many predictions regarding births, or lack thereof, for celebrities. One such example was "Kylie Minogue: No pregnancy / children" (Milton Black, 2006). We scored that as correct, but isn't *not* having a child in any one-year period more likely than having one? That was a safe bet with a substantially greater than 50 percent likelihood.

The fact that the GAPPP team was often overly generous in scoring 50:50 and some even more likely predictions as correct, rather than expected, should make it clear that we were not determined—as I predict will be claimed by the psychics—to prove them wrong. When psychics rate themselves, they always come out smelling like roses. As Saunders points out in the GAPPP article in *The Skeptic*:

> It is not uncommon for those making predictions to pore over their work and highlight successes either real or perceived. An example of psychics assessing their own predictions can be found in an archived web page from Sarah Kulkens and her mother Kerry Kulkens dated from 2006, where 176 predictions were listed going back to 2001. The predictions they considered to have come true … equate to about 75%.
>
> These include:
>
> • The start of major Earth changes
>
> • Wild storms and bush fire danger
>
> • Using anti-gravity to lift heavy objects will become a reality instead of a dream.

Damn! Did I miss the deals on anti-gravity devices on Amazon during its Cyber Monday sales?

Another thing psychics do to increase their apparent accuracy is to make predictions regarding things that are *anticipated* to happen. We did not score these 15 percent of items in the database as *correct* but instead marked them as *expected*. Here are some examples:

• Certainly, one area that is going to do fantastic stuff is the internet, specifically areas like shopping. (Simon Turnbull, 2000)

• I see large earthquakes happening in several parts of the world in particular California (United States), Mexico, China, and Japan. (Harry T, 2015)

• Snowstorms in Germany. (Julie McKenzie, 2020)

A common tactic is for psychics to make many vague predictions. In this way, they can claim these were correct by retroactively finding *something* that sort of fits. Having a large set of these also drives down the percent of absolutely wrong predictions. So now let's look at the type of predictions we scored as *too vague* and thus unverifiable:

• Before the end of the year, we'll also see a lot of underhand things revealed in politics and business. (Angelica Danton, 2001)

• Unexpected objects falling to Earth. (Sarah Kulkens, 2007)

• I see a purple flower from a cactus being used to prevent brain bleeding. It will be beneficial to brain surgery. (Kim Dodgson, 2013)

• A global charity could appeal to her [Nicole Kidman's] soft-hearted side. (Jenny Blume, 2016)

• Who will win the U.S. election? … the numerology shows that both Mr. Trump and Mr. Biden have a chance of winning the next U.S. presidential election. It is still up to the people to decide. (Sarah Yip, October 21, 2020)

Next, let's look at a sample of the predictions that we scored as absolutely *wrong*, which amounted to 53 percent:

• Using anti-gravity to lift heavy objects will become a reality instead of a dream. (Kerry Kulkens, 2001)

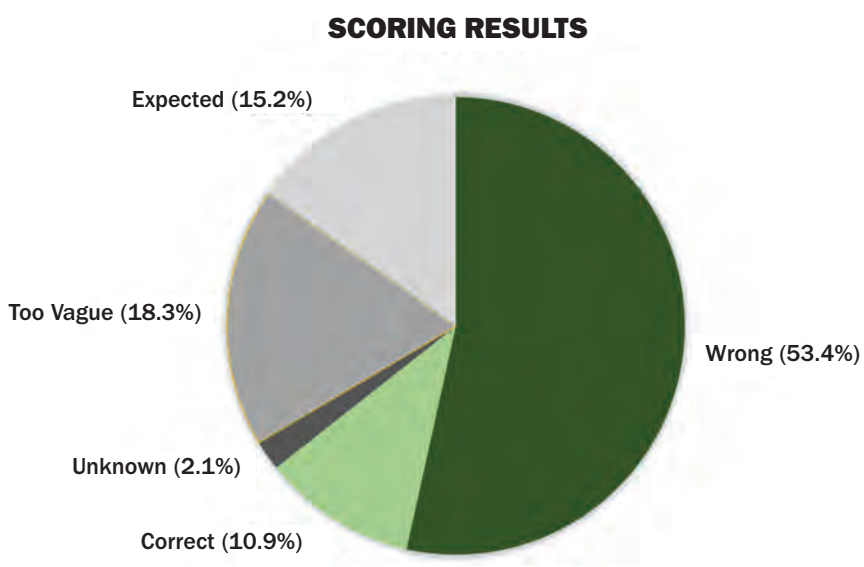
• I don't think authorities will catch Osama bin Laden next year. I don't think they'll ever catch him. I think it is likely he has had plastic surgery to hide his identity. (Sandor, 2005)

• I also see Sydney being hit with a rather large earthquake, which will cause a lot of damage, within the next few years. (Rebecca Millman, 2013)

• Hillary Clinton will be the next president for the United States. (Kris Currier, 2016)

• Joe Biden will be nominated but will drop out before the election. Donald Trump to win election. (David the Medium, 2020)

Maybe you are thinking that 53 percent *wrong* doesn't seem too bad. But if the items that were scored as *expected* (15 percent), *too vague* (18 percent) and *unknown* (2 percent) are all eliminated from the data, then the percentage *wrong* becomes 83 percent—a horrendous failure rate by anyone's standards. But making many vague and expected predictions obfuscates this reality, making psychics seem far less wrong than they actually are.



One last thing: when combing through their own past predictions to rate success, no psychic ever mentions what they *didn't see coming*. To showcase this, the GAPPP team spent time determining newsworthy Australian and global events we thought *should* have been too big to miss. If these people could predict relatively uneventful things, then predicting the big ten items we documented for each year the project covered should have been a piece of cake. Here is just a small sample of significant events that were not predicted:

• 2000: Stalemate in U.S. presidential election. Supreme Court decides the winner.

• 2001: The 9/11 attack on the United States happens.

• 2003: The Space Shuttle *Columbia* burns up on reentry, the first such accident in the U.S. space program.

• 2004: An Indian Ocean earthquake and tsunami on December 26 kills an estimated 227,898 people in fourteen countries.

• 2009: Pop singer Michael Jackson dies at the age of fifty.

• 2010: An 8.8-magnitude earthquake, one of the largest in recorded history, occurs in Chile, triggering a tsunami in the Pacific Ocean killing at least 525 people.

• 2011: A tsunami triggers the Fukushima nuclear disaster.

• 2014: Malaysia Airlines Flight 370 disappears.

• 2017: 'Oumuamua, the first known interstellar object, is detected passing through the solar system.

• 2019: A fire engulfs the Notre Dame Cathedral in Paris, destroying much of the historic building.

• 2020: The COVID-19 pandemic begins.

Failing to predict *a single one* of the over 210 items such as these should be downright embarrassing to people claiming clairvoyance. It's almost as if none of these people are actually psychic. Sometimes absence of evidence *is* evidence of absence.

Finally, let me say that it was a great privilege to be part of this project, and I encourage readers to access the full report as published by Richard Saunders. It is available online at tinyurl.com/GAPPP. ■

Rob Palmer writes "The Well-Known Skeptic" column for skepticalinquirer.org.

[POSTCARDS FROM REALITY

ROBYN E. BLUMNER

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Remembering Carl Sagan

Image Credit: Kenneth C. Zirkel - Own work, CC BY-SA 4.0, Wikipedia

The title of this piece suggests I might have known Carl Sagan. Sadly, I did not have that honor. That's not to say I didn't have the opportunity to get to know him. I was an undergraduate student at Cornell University in the early 1980s when Sagan was a professor of astronomy there.

But I didn't take any of his classes. The PBS television series *Cosmos* had aired in 1980, the same year the accompanying book was published, spending seventy weeks on *The New York Times* Bestseller List. That cemented Sagan's international fame. His classes were really hard to get into. And while I was interested in astronomy, I had no appetite for chasing stars.

Now I'm sorry I didn't try.

Carl Sagan, as many of you know, was part of an illustrious group of scientists and skeptics who founded the Committee for the Scientific Investigation of Claims of the Paranormal (CSICOP). That organization eventually became the Committee for Skeptical Inquiry (CSI), now a program of the Center for Inquiry (CFI). I know, it's a lot of names and acronyms.

The important take-away is that Sagan is a pivotal and essential part of CFI history. It's why CFI West in Los Angeles has named its theater after him and his coauthor and widow, Ann Druyan.

In 1994, Sagan appeared at a CSICOP conference in Seattle and gave the keynote address. Read (or reread) *The Demon-Haunted World: Science as a Candle in the Dark*, as I did recently, and the themes emanating from Sagan's keynote speech are deeply explored in his book that was published just two years later. That was also the year of his untimely death at sixty-two from bone marrow disease and ultimately pneumonia.

I like to think that Sagan's prepa-

The themes emanating from Sagan's CSICOP conference keynote speech are deeply explored in his book that was published just two years later.

ration for his keynote inspired him to write his seminal book on skepticism. Whether that speech had anything to do with the book or not, it was nice to see Skeptical Inquirer's eminent editor, Kendrick Frazier, prominently mentioned in the book's acknowledgements, along with so many of CSICOP's founders, including Martin Gardner, Isaac Asimov, Paul Kurtz, and James Randi.

One of the formative stories that Sagan told during his speech that didn't appear in the book was of how his childhood curiosity of the nature of stars led him to his first library card.

In Sagan's telling, when he was very young no one he asked could tell him what the stars that appeared in the night sky were, and no one seemed to think the question was very interesting. Finally, his mother told him he could find out for himself and gave him a library card. At the Utrecht branch of the Brooklyn public library, Sagan gathered up the courage to ask the librarian for a book on stars.

She went away and returned with a book. Sagan opened it, and there were pictures of Veronica Lake and Clark Gable. Not at all what he intended.

Sagan went back to the librarian and explained that he meant *real* stars. "She thought this was funny," Sagan remembered. But this time she got him what he was seeking, an act that helped launch a future astronomer.

I would be remiss if I didn't mention the delight Sagan held for Skeptical Inquirer magazine. In both his speech and in *The Demon-Haunted World*, Sagan talked about the anticipation he felt when new issues appeared. Sagan wrote:

> On the day it arrives, I take it home from the office and pore through its pages, wondering what new misunderstandings will be revealed. There's always another bamboozle that I never thought of. Crop circles! Aliens have come and made perfect circles and mathematical messages in wheat … .
>
> That's all they can conceive the extraterrestrials doing … making crop circles in wheat? What a failure of the imagination!

Expanding his famous 1987 article in *Parade* magazine titled "The Fine Art of Baloney Detection," Sagan spent seven pages in *The Demon-Haunted World* laying out his enduring "baloney detection kit." This set of tools for skeptical thinking is still *the* essential list of ways to separate what is plausibly true from what is false or fraudulent.

Were Sagan alive today, he would not be comforted by the notable backsliding on this front. Today's rampant disinformation and misinformation distributed on a scale so massive it was unimaginable twenty-five years ago have led to all sorts of societal ills, not the least of which is a large population of coronavirus-unvaccinated Americans who have allowed political tribalism to overwhelm their critical faculties. This national outbreak of irrationality reminds me of one of Sagan's favorite cartoons. It's a fortune-teller examining a client's hand and confidently declaring, "You are very gullible."

The current national outbreak of irrationality reminds me of one of Sagan's favorite cartoons. It's a fortune-teller examining a client's hand and confidently declaring, "You are very gullible."

At the end of *The Demon-Haunted World*, Sagan got more political. He lauded America's founders and their prescience in setting up the country's system of government. He provided a full-throated defense of the principles of free speech and church-state separation. And he talked extensively about the European witch mania that led to the torture and death of thousands of innocents in the fifteenth to eighteenth centuries, as a cautionary tale for our own time. Sagan rightly credited the ideas of the European Enlightenment with helping to curtail the brutal insanity.

Which leads to his most trenchant warning. Sagan wrote:

> If we are absolutely sure that our beliefs are right, and those of others wrong; that we are motivated by good, and others by evil; that the King of the Universe speaks to us, and not to adherents of very different faiths; that it is wicked to challenge conventional doctrines or to ask searching questions; that our main job is to believe and obey—then the witch mania will recur in its infinite variations down to the time of the last man.

The antidote to this, Sagan said, is understanding superstition using the tools of skepticism, employing the scientific method, and upholding the ideals of the Enlightenment.

It still is.

I hope Carl Sagan would be proud of the ongoing work of CSI and our flagship Skeptical Inquirer magazine. For—make no mistake—it is his legacy we are continuing to uphold. ■

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Murder at Mile End: Solving 'The Case Conan Doyle Couldn't Solve'

"Ah, Watson," said Sherlock Holmes, gazing absently out the window into the swirling fog. "I've been mulling over a case from before our time."

Seated beside the fire, I turned to him. "I should be glad to hear of any case you find instructive," I replied.

"Well," said he, "It occurred in 1860, one your literary agent, Arthur Conan Doyle, later struggled with, as you may remember. It has since been called 'The case Conan Doyle couldn't solve!'"

"Yes, I recall something of the affair. I believe it was the murder of a rich old lady in the East End—bludgeoned, if memory serves me correctly. But wasn't the murderer soon caught, tried, and hanged outside the walls of Newgate?"

"Very good, Watson! Friend Doyle was having misgivings about 'circumstantial evidence'—a very tricky thing. As I have myself said, 'It may seem to point very straight to one thing, but if you shift your own point of view a little, you may find it pointing in an equally uncompromising manner to something entirely different.'"[1]

* * *

The Old Case

Having been a Sherlockian since I was a boy, it amused me to begin with the foregoing little pastiche. It does help set the stage for my own delving into the Emsley case and challenging a newly revisionist assessment by Sinclair McKay (2017).

We pick up the Emsley matter in the spring of 1901, some forty years after the murder. Arthur Conan Doyle was considering bringing his fabled detective back to life. Having tired of his creation, Doyle had killed Holmes off in a story in 1891 by a fatal plunge—locked in a death struggle with his arch enemy Moriarty—from a precipice of Switzerland's Reichenbach Falls. (I too

have climbed out on that identified ledge while my German skeptic friend Martin Mahner prepared to snap my picture. "Back just a little farther," he said. "Easy for you to say, Martin!" I remarked.)

As Conan Doyle prepared for Holmes's resurrection in *The Strand* magazine, he examined the old murder in an essay titled "The Debatable Case of Mrs. Emsley" (Doyle 1901). Yet the famous writer seemed to remain puzzled. States McKay (2017, 4):

> Having raised his own doubts about the conviction, Conan Doyle left the story of this murder dangling without a final conclusion, leaving it to his many thousands of readers to make their own deductions. It was as if he was just as bewildered as the judge had been at the Old Bailey.

Shall we hope to do better?

Horror Revealed

A lady of seventy, Mary Emsley lived alone in Mile End Old Town in a terraced house at 9 Grove Road. Twice widowed, she was quite wealthy, and from her second-floor window could survey dozens upon dozens of houses belonging to her. She rented them out and, quite active, collected many of the rental payments herself.

On the morning of Tuesday, August 14, 1860, a teenage boy arrived at her door with a message from his father. The boy knocked and waited. When his knocks went unanswered, the lad left, assuming she might be out shopping or attending to business. The boy repeated the ritual on each of the next several days, telling his father on Friday he had never had a response. The father, one of Mrs. Emsley's respected tradesmen Walter Emm, began to feel uneasy.

However, appreciating the customary lines of authority, he sought the old lady's solicitor, William Rose. The two immediately went to the home, and Rose himself tried the door without success. Deciding to forego a forced entry, he instead went to summon police. He also alerted two of Mrs. Emsley's stepsons, living close by. The four men, led by a Sergeant Dillon, went immediately to the house. The latter effected entry through an unfastened back door, and he and then the other four were soon inside. Oddly, the house's inner doors were all opened wide. As the group proceeded on the ground floor, they encountered the unmistakably foul odor of death (McKay 2017, 5–17).

That nauseating smell (which I have experienced in my own investigative work) became steadily more pungent as the police-officer–led group "proceeded upstairs" (according to an inspector's subsequent report) to "the front room." There they encountered the first thing amiss: a bloody foot impression on the landing. As they turned to a "lumber room" (i.e., a storage room), they discovered the very definite source of the overwhelming stench (Hayes 1860).

Mrs. Emsley lay face down with an arm almost reaching to the door. Under her other arm were two rolls of wallpaper—many rolls of which filled the room. (She had recently purchased these for sale to her tenants.) Great splashes of blood radiated away from her white-haired head, which was "against the door-post." The back of her head had been smashed in by two blows, and the brain was left exposed. Maggots writhed about the fatal wound. The nearby lower paneling bore an indentation; police interpreted it as the result of a first swing of some heavy instrument that missed. Higher up was the mark of a second blow (McKay 2017, 38).

No crime-scene photographs would be taken. Although now a mainstay of police investigation, in 1860 those would be some two decades in the future. One bizarre element that was therefore not documented—and was even omitted in the first police report—was the fact that the elderly victim's long skirt and petticoat had been pulled back, exposing her bare legs and thighs. The clothes were hitched so as to partially cover her back, up to and including the lower half of her bloody head. Asks McKay (2017, 20), given such a brutal murder, "Who would then defile the body of an old lady in this fashion?"

As it happened, a coroner's inquest yielded the solution to that minor mystery, which had nothing to do with obscenity but instead utter callousness of the one who committed so brutal a crime. The coroner, Dr. Lawrence Gill, explained that the clothing bore smears that indicated the killer had used it *to wipe his bloody fingers*!

As the group proceeded on the ground floor, they encountered the unmistakably foul odor of death.

Astonishing Discovery

The police had trouble making progress in their investigation, so during the second week after the murder they put out leaflets offering rewards of up to 300 pounds—100 pounds by Her Majesty's Government and a further 200 pounds by another of her solicitors. The offer was for information leading to the conviction of the guilty person or persons, and for that time it was a grand amount. Meanwhile, police were searching for items known to have belonged to Mrs. Emsley that had gone missing—notably a rental check and her little book of rental postings (McKay 2017, 84–85, 244).

Then came a momentous break in the case. A man named James Mullins—a laborer who had worked for Mrs. Emsley for nearly a year—claimed he had been shadowing his own suspect: the old lady's rent-collecting agent, whom we have already met, Walter Emm. Mullins told a Sergeant Tanner he had kept watch at Emm's cottage. Early that morning, Mullins had observed Emm carrying a parcel to a rickety old shed about fifty yards away and then exiting about ten minutes later without the package. As Mullins told the sergeant, Emm acted suspiciously, looking around as if to make sure no one was watching.

"What do you suppose the parcel contained?," the sergeant asked.

Mullins replied, "I do not know, but I will show you where the shed is."

Sergeant Tanner was commendably cautious. He asked Mullins to meet him and an Inspector Thornton at Scotland Yard the next morning, from where the

three of them would go to the shed that allegedly contained the mystery parcel. The next day was Sunday, and the policemen took Mullins on a journey by horse-drawn cab to the Emm site, a brickfield that had once belonged to Mrs. Emsley's second husband. As they rode, Mullins told the officers how he had for days been suspicious of Emm as the murderer. "You know I am very clever in these matters," boasted Mullins, who avowed he had "been working hard day and night to discover the murderer."

At the brickfield, the two policemen, seeing Emm emerge from his cottage, left Mullins behind the board fence and approached the shed. They met up with another policeman, a Sergeant Thomas. The officers asked Emm if he had been at the shed at the time alleged the previous day, and he said he had not, having been ill. He insisted his wife would confirm that. Inspector Thornton immediately sent Tanner to the cottage to question Mrs. Emm, and he instructed Thomas to search the shed. He turned up nothing, but an angry Mullins came up to them, barged into the shed, and insisted Thomas pull at some bricks and a stone slab, thereby uncovering a parcel wrapped in paper and tied with string.

Emm was flabbergasted as he watched the parcel being opened. Its contents appeared to incriminate him. "Good God," he stammered, "this is a foul plot!" Perhaps it was, Inspector Thornton thought. Recall that previously Mullins had only claimed to see Emm take a parcel into the shed and come out without it. He had not seen the actual hiding spot, having been, he said, watching from a distance. The inspector was beginning to focus increasingly on James Mullins over Walter Emm, but for good measure he asked both to accompany him to the nearest police station. Mullins was cooly annoyed; Emm was sobbing in terror (McKay 2017, 104–107).

Two Suspects …

Walter Thomas Emm was forty-five years old. He was a shoemaker as well as serving as a rent-collector for Mrs. Emsley. He rented his own cottage from her, but he was so trusted he did not have to pay weekly. Indeed, he had a special arrangement with the old widow that allowed him to pay annually. Thus, he had no petty motive to murder her for some small sum that might have been due. All in all, Emm was a successful businessman with a respectable family that included well-schooled children, and he had a fine reputation. It enabled him, although charged for "being concerned in the murder of Mrs. Emsley," to achieve an uneasy liberty on bail (McKay 2017, 105, 111–122, 123).

Emm had an excellent alibi for the evening of the murder. He had gone to Stratford to collect rent for Mrs. Emsley, and four witnesses deposed that he was with them until almost midnight, whereupon he returned to his cottage and stayed there until the following morning. Moreover, on the morning that Mullins claimed he saw him deposit the parcel between eight and nine o'clock, Emm was still in the cottage at that time. He would eventually be completely exonerated of any wrongdoing (McKay 2017, 137–138, 194).

For his part, Mullins was lodged in a filthy prison at the edge of London to await trial. A deeper look into his background revealed that he had once been a policeman himself. By the early 1840s, he had been sent as an undercover agent to Ireland, but that went badly and eventually, working as a railway officer, he was convicted of theft and served six years at Dartmoor (McKay 2017, 153–179).

Some of the evidence that was produced against Mullins was at best doubtful, including a boot that might have made the crime-scene's bloody footprint, except it apparently had no blood upon it, and a hammer that might have made the estimated two death blows but that likewise seemed absent of blood traces. Such evidence in the old case discouraged Arthur Conan Doyle who lamented: "The case was prejudged by the public before the prisoner had appeared in the dock, and the evidence which the police had prepared against him was not such as to cause them to change their opinion" (McKay 2017, 194–197; Doyle 1901).

On the other hand, Mullins had no alibi and indeed was seen at eight o'clock on the Monday night in question very near Mrs. Emsley's house. Other witnesses testified to seeing him apparently going to that area on that fateful evening. One noted the next morning he had especially "bulky pockets." He was connected to items belonging to Mrs. Emsley—including a silver pencil case his wife had been in possession of and of course the items in the parcel that evidence pointed to his having planted. That was obviously done to incriminate Emm so Mullins could get the rewards offered. His original motive for murder had apparently been to find substantial cash in Mrs. Emsley's purse (McKay 2017, 194–195, 197, 233).

Let us pause here to reconsider the crime scene to put together a partial profile of the killer. For him to have been let into the house, he was surely someone the cautious Mary Emsley knew, and James Mullins was one of her employees. That she was found upstairs and had two rolls of newly purchased wallpaper under her arm, intended to be sold to tenants, indicated the pretext the killer probably used for entry. If he feigned an interest in making a purchase, he probably thought that might lead to a discussion of money. The killer had with him a weapon, and Mullins always carried a heavy, sharp-pointed plasterer's hammer. Finally, on the floor of the deceased's bedroom was found a distinctive key; it matched the key to Mullins' lodgings, which had gone missing (McKay 2017, 108–109, 148).

James Mullins was tried at the Old Bailey where he sat in the dock on October 25, 1860, during a trial that lasted just two days. The prosecution was conducted by a Mr. Parry, and the defense by a Mr. Palmer and a Mr. J. Best. Parry opened by declaring the case "one of the most cruel and barbarous murders ever committed" and again a "most atrocious crime." He acknowledged that such a crime is typically committed in secret, that is, without eyewitnesses. But he observed, in part, that the prosecution could "rely on a number of facts, each of greater or lesser importance, but all pointing in one direction and one alone." "This," he said, "is what is called circumstantial evidence." Such a series of facts, he insisted, was quite enough for the jury

to depend on.

The defense did the best it could against the evidence, trying to cast doubt here and there. But in the end, Mr. Parry carried the day. The judge, Lord Pollock, gave his own summary of the case, agreeing that the person who actually placed the telltale parcel in the shed was indeed the murderer. Clearly that was not Emm but Mullins, who was trying to frame Emm. The jury took slightly less than an hour to reach its guilty verdict. Mullins then asked to say "a few words" and gave an impassioned statement of his innocence, but he made no mention of the parcel or its contents.

On Monday, November 19, 1860, James Mullins climbed the scaffold outside the high wall of Newgate prison. The bolt drawn, the drop (trap door) fell, and he appeared to die with his body giving little more than a shrug. (The hanging was reported in the *Evening Standard* of November 20, 1860.)

As to Conan Doyle, I would say that solving actual cases typically represents a more difficult challenge than creating storybook ones.

Or Three?

A third suspect had briefly been a subject of interest. Mrs. Emsley's across-the-road neighbor Caroline Barnes thought she had seen someone in the house on the day after the murder (Tuesday, August 14). Again, a James Stephenson said he saw a tall man coming from a garden, "apparently from number 9" (Mrs. Emsley's), that Tuesday morning as well. Stephenson identified the man as a Mr. William Rowland. The two witnesses' naming of another suspect was to trouble Arthur Conan Doyle as he studied the case four decades later (McKay 2017, 229; Doyle 1901).

In fact, however, nothing ever came of either witness's supposed recall, and I think each had confused what had happened on a different (probably earlier) day with that of Tuesday the fourteenth. As to Conan Doyle, I would say that solving actual cases typically represents a more difficult challenge than creating storybook ones. The two processes are very different, as Conan Doyle himself should have known.

Certainly Doyle was wrong to broadly disparage circumstantial evidence. As prosecutor Parry explained to the Emsley jury, they could use an accretion of such evidence to make a very powerful case. This has sometimes been called the fagot argument—the idea that while a single stick may be easily broken, a bundle of sticks (a fagot) may resist breakage. In addition, there is what is termed *corroborative evidence*—that is, one or more facts that bolster or strengthen others. For example, evidence that Mullins was the culprit gained support from a witness (another of Mrs. Emsley's tenants) who said Mullins once complained to her that the old lady was insufferably stingy and that "it was a pity such an old wretch should be allowed to live" (McKay 2017, 211).

Author Sinclair McKay, however, has managed to discover—or make out of whole cloth—yet one more suspect: indeed a man of the cloth, as it were. This individual, Joseph Biggs, described himself as "a minister of the [Catholic] Apostle Church" (McKay 2017, 93), and he paid calls on Mrs. Emsley, as she occasionally did him. Apparently, his visits had a romantic element; hers did not. The two were simply a widower and widow looking for companionship.

Biggs played only a very minor role in the Emsley case, but McKay—like other true-crime writers who wish to find a suspect other than the obvious one—is opportunistic. Soon he has elaborated on a detail that fascinated Conan Doyle: the testimony of the woman, Caroline Barnes, who believed she saw someone (was it Biggs?) in Mrs. Emsley's house the morning after the brutal murder. And that is pretty much it—a failed exercise, in my opinion, but adding several pages of pure supposition (McKay 2017, 275–287).

For those who wanted more of James Mullins—if not a substitute murderer—there was a phrenology "expert" named C. Donovan who, after the hanging, had seized the opportunity to feel the bumpy contours of Mullins's lifeless head. Supposedly, Donovan's pseudoscientific analysis revealed:

> The head of Mullins is of the lowest sneaking type. … He had a quick, acute intellect; was intellectually clever; morally, a dunce. … He was observant, smooth, specious, crafty in the highest degree. He had been through "sin's long pilgrimage" and arrived, after many weary journeys, at the terminus where such sinners receive their due. (Donovan 1860)

Then, in just a few weeks, the likeness of James Mullins achieved further infamy by being exhibited in the long-time Chamber of Horrors of Madame Tussaud's wax museum. To the chamber's recreations of true-crime murder scenes—lit with colored gas lights—was added "a full-length portrait model of the murderer James Mullins with a plan of Emm's house and shed where the parcel was found" (*East London Observer* 1861)—just the scene that haunted Arthur Conan Doyle's thoughts forty years later and is once again handed down to us in our time.

* * *

"Case closed, I say, Watson. It really was quite elementary after all."■

Note

1. From "The Boscombe Valley Mystery" by Arthur Conan Doyle, short story collected in *The Adventures of Sherlock Holmes* (1892); republished in *The Complete Sherlock Holmes*, (Doyle [n.d.] 1930, 226–244).

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[THE PHILOSOPHER'S CORNER MASSIMO PIGLIUCCI

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How to Talk to Science Deniers

There is a pernicious belief spreading within the skeptic community that it's a waste of time to talk to science deniers, so our efforts are better spent, well, doing *what*, exactly? I've been to plenty of skeptic conferences where we all talk to each other and pat ourselves on the back in recognition of just how cleverly we know how to debunk Gwyneth Paltrow's latest Goop nonsense. Meanwhile, Paltrow keeps laughing all the way to the bank.

A major reason advanced by some skeptics for why it is a waste of time to talk to what ought to be our primary target audience is an empirical finding known as the backfire effect. This is the alleged phenomenon by which if people who are firmly convinced of a certain notion are presented with contrary evidence, they will dig in more deeply. Thus, the lamentable result of activities such as fact checking is actually to reinforce the very beliefs we skeptics attempt to undermine.

Except, as my colleague Lee McIntyre of the Center for Philosophy and History of Science at Boston University has pointed out in an enlightening article in *Nature* (McIntyre 2021), the original research, published in 2010, "demonstrating" the backfire effect has proven to be unreproducible (just like about half of research in psychology more generally; see Weir 2015). Oops.

Brendan Nyhan of Dartmouth College has carried out research, mentioned by McIntyre, showing that media outlets jumped on the backfire effect, distorted the original findings, and spread the notion that it is far more powerful and generally applicable than even the original authors had suggested (Nyhan 2021). In fact, Nyhan documents that corrective information does, in part, counteract belief inaccuracy. The problem, it turns out, is a different one: the effects of fact checking do not last and they do not appear to be cumulative. Why? Because they are diluted or begin to decay as a result of active misinformation originating with political leaders and the media.

This means that our concern as skeptics shouldn't be with the alleged backfire effect but rather with the originators of distorted narratives and the purveyors of inaccurate beliefs. Nyhan writes:

> The best approach is to disrupt the formation of linkages between group identities and false claims and to reduce the flow of cues reinforcing those claims from elites and the

media. Doing so will require a shift from a strategy focused on providing information to the public to one that considers the roles of intermediaries in forming and maintaining belief systems.

McIntyre makes another evidence-based suggestion for skeptics: shift from content to technique rebuttal. Content rebuttal is a form of argumentation that we are all familiar with: presented with a given claim, say that homeopathic "cures" work, we deploy several facts about chemistry and biology aiming at arguing that no, they don't. There is evidence that this may work, but it requires a certain degree of technical knowledge on behalf of the skeptic and, arguably, from our audience.

Technique rebuttal, by contrast, focuses on more general principles, challenging believers to explain why they think something is the case. The reason this is easier is that science deniers tend to rely on a small set of techniques that are easily challenged: cherry-picking of the evidence, conspiracy theories, fake experts, and insistence that science must provide unchanging and complete answers. Indeed, making people reflect on their epistemic practices is arguably far more important and wide ranging than making them reflect on individual claims, as the practices apply across the board no matter what the claim.

McIntyre cites Philipp Schmid and Cornelia Betsch at the University of Erfurt (Germany), who have conducted a series of experiments to determine which strategies are effective in rebutting science denialism (Schmid and Betsch 2019). The first finding was that *not* responding to the claims of deniers has a negative impact on behaviors that we favor, such as getting vaccinated. By contrast, both providing facts (content rebuttal) and exposing the rhetorical moves of deniers (technique rebuttal) had a positive effect. Interestingly, Schmid and Betsch found no evidence of a backfire effect and also no evidence that complex rebuttal strategies are more effective than simple ones. Apparently, what is needed is a wedge that makes deniers uncertain about the basis of their beliefs. The authors conclude: "As science deniers use the same rhetoric across domains, uncovering their rhetorical techniques is an effective and economic addition to the advocates' toolbox." It's not rocket science, folks!

Here is another evidence-based piece of advice from McIntyre: listen more than you talk. He refers us to Thomas Lemaitre and collaborators at the Centre de Recherche du Centre Hospitalier Universitaire in Sherbrooke (Quebec, Canada), who have analyzed the impact of a twenty-minute session, during which they listened to parents' concerns and provided basic information about vaccines, on the parents' subsequent decision to vaccinate their newborns (Lemaitre et al. 2019). Children from the experimental group (whose parents had been exposed to the session) had a 9 percent increased chance to arrive at a complete vaccination status between three and twenty-four months compared to children from the control group (no twenty-minute session). Nine percent may not seem like a lot, but not only is it enough to save a significant number of lives, the figure was the result of a single short intervention. Likely, repeated interventions would bring the percentage further up.

McIntyre even did something I bet few skeptics have ever done: he went to a flat-earthers conference, not to make fun of those people but to earnestly engage them in conversation, Socratic-style. Instead of delivering sarcastic remarks and canned lectures on how silly and unfounded flat-earthism is, McIntyre asked his interlocutors what sort of evidence might possibly change their minds. When they said something like, well, I need proof, he would come back and ask them why, exactly, currently available evidence was judged insufficient. He also asked them why they trusted the sources that they tended to rely on. And so forth.

Did he manage to convert any flat-earthers on the spot? Of course not. Then again, people rarely change their minds about something they care deeply about and on which they have invested a significant amount of time. But he learned how to listen to them, showing them that a skeptic can be someone knowledgeable and respectful to talk to. Who knows how many of those people, perhaps for the first time in their lives, went home and finally started doubting their own certainties.

Of course, you don't have to attend flat-earth conferences to practice field skepticism. You can talk to neighbors, friends, and relatives or volunteer for local events in your community, especially in schools. The trick, again, is not to give a lecture projecting the vibe of an all-knowing sage but rather to engage in Socratic dialogue with others. The Stoic philosopher Zeno of Citium used to say that the reason we have two ears and one mouth is because we should listen twice as long as we speak. As an account of the evolution of our sense organs, Zeno's idea is off the mark. But as advice on how to constructively interact with others, it's golden.

By the way, McIntyre has written an entire book based on his Socratic conversations: *How to Talk to a Science Denier: Conversations with Flat Earthers, Climate Deniers, and Others Who Defy Reason* (MIT Press, 2021). It would make a valuable entry in your skeptic library. ■

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[REALITY IS THE BEST MEDICINE HARRIET HALL

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The World's Most Deadly Animal

Animals can be hazardous to human health. When asked to name the most dangerous animal, many people will give the wrong answer. Sharks have captured the attention of the public, and other animals that kill people may come to mind, such as black widow spiders, rabid dogs, and venomous snakes. And don't forget the human animal: gun control is a hot topic. When humans murder other humans with guns, it gets a lot of press. We are subject to the availability heuristic: if we can think of examples or have recently read a news story about it, we tend to overestimate its prevalence. An article on BBC's *Science Focus* magazine website reports the actual number of people killed by the top ten animals that kill people, either directly or indirectly by transmitting disease ("Top 10" n.d.). Sharks didn't even make the list. The actual number of deaths recorded for each deadly animal around the world may surprise you. Here they are (the number represents number of humans killed each year):

10. Lions: 200
9. Hippos: 500
8. Elephants: 600
7. Crocodiles: 1,000
6. Scorpions: 3,300
5. Assassin bugs (by transmitting Chagas disease): 10,000

Note: Chagas disease occurs only in the Americas. It is particularly icky. The so-called "kissing bug" poops while feeding. The poop gets rubbed into wounds and mucous membranes, and the disease can damage the heart muscle, leading to death decades later. It has been suggested that Chagas disease contracted during the voyage of the *Beagle* might have contributed to Charles Darwin's lifelong ill health and his death.

4. Dogs (especially those that carry rabies): 59,000
3. Snakes: 138,000
2. Other humans (only counting homicides): 400,000
1. Mosquitos: 725,000

Other animals can also be done in by mosquitos; your pet dog may succumb to the deadly heartworm disease, where masses of worms up to a foot long accumulate inside the heart. Heartworm disease is transmitted only by mosquitos. It can be treated, but it sometimes kills even with treatment. It's better to prevent it. Protect your puppy from those deadly mosquitos!

Mosquitos can transmit several viral and parasitic diseases to humans. *Aedes* mosquitos transmit Chikungunya, dengue, lymphatic filariasis, Rift Valley fever, yellow fever, and Zika. *Culex* mosquitos transmit Japanese encephalitis, lymphatic filariasis, and West Nile fever. *Anopheles* mosquitos transmit lymphatic filariasis and malaria.

Dogs bite people. Although we talk of mosquito "bites," that's inaccurate. Mosquitos don't exactly bite—at least not in the way that dogs do. Dogs have teeth; mosquitos don't. The male mosquito is harmless. The female mosquito inserts her proboscis through the skin and uses it to suck up blood and inject saliva. The itchy bump that annoys us is our body's reaction to her saliva. Some people are more attractive to mosquitos than others. I used to come home from family camping trips with dozens of itchy bumps, while other family members had only a few or none at all. You might say I was a sucker for bloodsuckers; I just thought "That sucks." I didn't appreciate being "in good taste."

Malaria

The most serious disease transmitted by mosquitos is malaria, but it's not automatic. To get malaria from an encounter with the deadly mosquito,

- The mosquito must be female;
- She must belong to the genus *Anopheles*. *Culex* and *Aedes* species do not transmit malaria, although they transmit several other diseases;
- She must be one of the thirty to forty species of *Anopheles* mosquitos (out of a total of 340) capable of transmitting the disease;
- She must have previously sucked blood from an infected human or animal; and
- She must inject viable malaria organisms through her proboscis.

Malaria is one of the world's most serious public health problems. The World Health Organization tells us 409,000 people died of malaria in 2019.

The Center for Disease Control and Prevention (CDC) has a handy map showing areas of the world where malaria is endemic (Centers for Disease Control and Prevention 2020). If there is no malaria in the area, there is no risk.

Malaria is one of the world's most serious public health problems. The World Health Organization (WHO) tells us 409,000 people died of malaria in 2019, 67 percent of them children under the age of five (World Health Organization 2021). Most cases and deaths (94 percent) were in Africa. Babies and pregnant women are particularly susceptible. During World War II, 500,000 American troops were infected in the South Pacific, and 60,000 died.

Malaria parasites are protozoa belonging to the *Plasmodium* genus. At least four species are known to infect humans: *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae.* The parasite's life cycle is complicated and requires two hosts. The terminology can be confusing. When a mosquito takes a blood meal from an infected host, it ingests male and female gametocytes. These mate in the mosquito's gut, producing sporozoites. After ten to eighteen days, the sporozoites migrate to the mosquito's salivary glands and can be transferred to a human host. In the human, the sporozoites mature and multiply in the liver, producing schizonts. When schizonts rupture, they produce merozoites, which then infect red blood cells. There they develop into ring-stage trophozoites, which develop into schizonts, in turn rupturing and releasing merozoites.

After an incubation period of a week to a month, the infected human develops symptoms such as fever, chills, sweats, headache, nausea and vomiting, body aches, and general malaise. Attacks of fever can be tertian (recurring every third day) or quartan (recurring every fourth day). Or the parasite may enter a dormant stage, unexpectedly relapsing many years later. In severe cases, every part of human physiology may be affected. Cerebral malaria can cause abnormal behavior, impairment of consciousness, seizures, coma, and neurologic abnormalities. Destruction of red blood cells can cause serious anemia. The lungs, kidneys, blood pressure, and coagulation system can be affected. The patient may develop jaundice. In rare cases, the spleen can rupture. There may be long-term consequences, especially in children, including deafness, blindness, and palsies.

History

Periodic fevers have been recognized throughout recorded history, and the parasites that cause malaria have been detected in fossils millions of years old. The name "malaria" comes from the Italian words for "bad air." In the prescientific era before germ theory, malaria was believed to be caused by fumes emanating from swamps. It came from the swamps all right, but it was brought by mosquitos that lived there, not by fumes. Malaria may have contributed to the fall of the Roman Empire.

Tertian and quartan fevers were recognized long before their cause was known. Spanish Jesuit missionaries in South America learned of an effective treatment—cinchona bark—from the Quechuas and introduced it to Europe in the early 1600s. It worked for malar-

ial fevers because it contained the effective anti-malarial drug quinine. Fevers were indistinguishable from each other in the prescientific era before the discovery of microorganisms and the germ theory of disease, so quinine was used to treat all fevers. Sometimes it seemed to work.

An Interesting Evolutionary Dilemma

An inherited enzyme deficiency, G6PD deficiency, affects 600,000 people worldwide. It can be asymptomatic or can cause anemia and death. It killed 33,000 people in 2015. Hemolytic crises are triggered by several factors, including illnesses and certain medications such as antimalarial drugs. A common trigger is eating fava beans, which are a common dietary component in some areas of the world and can cause favism. Favism can be triggered by just walking through a field where the plant is in flower (Editors n.d.a). Because G6PD deficiency tends to impair survival, one might wonder why evolution hasn't been able to eliminate it. The answer: it offers a survival *advantage* by reducing the risk of malaria and sickle cell disease.

Anti-Malaria Drugs

Quinine was the first successful use of a chemical compound to treat an infectious disease (Editors n.d.b). Up until World War II, quinine was the only effective drug for malaria, but it did not prevent relapses and could not be synthesized in commercial quantities. Synthetic derivatives were developed. Chloroquine was more effective than quinine but did not prevent relapses. Primaquine produced complete cures without relapses. As resistance to newer anti-malarial drugs developed, quinine resurfaced in some parts of the world as the drug of choice, despite its risk of toxic side effects, which can include hearing loss and visual disturbances.

Malaria itself was used as a treatment for tertiary syphilis in the early twentieth century before the germ theory of disease was universally accepted and before antibiotics were available. Patients were intentionally infected with malaria; the resulting fever killed the heat-sensitive spirochetes, and then quinine could be used to cure the malaria. Unfortunately, malariotherapy killed 15 percent of those treated with it. More recently, Henry Heimlich advocated malariotherapy as a cure for AIDS. Some small studies in China found that it reduced HIV viral loads, but it can't be recommended.

A Chinese scientist, Youyou Tu, won a Nobel Prize in 2015 for her work on artemisin, a derivative of wormwood. It proved very effective against malaria, but resistance to the drug has developed, and it doesn't prevent relapses. It is therefore commonly combined with other drugs.

Prevention

It's always preferable to prevent a disease in the first place than to play catch-up by treating it after it develops. Persons traveling to areas where malaria is endemic are advised to take a prophylactic drug before, during, and after travel. The specific drugs recommended vary by country. Drugs are not 100 percent effective and must be combined with personal protective measures, such as long sleeves, insect repellants, and bed nets. For people living in endemic areas, mosquito control measures can reduce the risk. Indoor spraying, eliminating standing water that harbors mosquito larvae, and housing modifications can be helpful. Insecticide-impregnated bed nets are estimated to have saved the lives of 250,000 infants in sub-Saharan Africa between 2000 and 2008. Bed nets are inexpensive ($5 each) and are provided free by several organizations. Unfortunately, they have only reached a minority of those at risk (32.8 percent of African households owned at least one bed net in 2008 [Institute for Health Metrics and Evaluation 2010]).

A small phase 1 trial of a monoclonal antibody was promising, apparently preventing malaria in a few subjects who were exposed to a controlled infection after subcutaneous or intravenous treatment with the antibodies (Gaudinski et al. 2021). It's too early to know how effective it will be; further studies will be needed.

Vaccines

A vaccine for malaria has finally been developed after a decades-long effort. The RTS,S vaccine (trade name Mosquirix) was recommended for children in sub-Saharan Africa by the World Health Organization (WHO) in October 2021. A real breakthrough, it is the first vaccine ever for a parasitic disease. Unfortunately, it is only modestly effective, cutting the risk of infection by 40 percent and the risk of severe infection by 30 percent. And getting it to those who most need it will be problematic; it requires a series of four injections for infants who live in an area with poor access to medical care.

Counterintuitively, the most deadly animal is the smallest: mosquitos that transmit malaria. Despite their bad press, sharks kill only ten people per year. Those annoying little mosquitos do far more damage to humans than big scary sharks. ■

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[BEHAVIOR & BELIEF STUART VYSE

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Spiritualism and the Birth of Abstract Art

The Eye of the Lord, Georgiana Houghton, 1870 (author photo)

Georgiana Houghton's only major showing of her drawings in her lifetime was not a success. It was an elaborate affair at the New British Gallery in London organized at her own expense, but of the 155 pieces produced over a ten-year period, she sold only one. Nor was the critical reception particularly warm. According to a recent account, "most of the critics were surprised and alienated, dismissive, malicious, or amused" (Althaus 2021b, 34).

Despite this disappointment, today there is a growing recognition that Houghton's art is quite beautiful and worthy of our attention and that she—not the Russian painter Wassily Kandinsky[1] (1866–1944)—may have been the first to introduce works that were not tied to recognizable objects, or abstract art. For decades, art historians have placed the beginning of abstract art at 1910 when Kandinsky produced his first nonrepresentational works, but Houghton's exhibition of abstract drawings was held forty years earlier in 1871. Furthermore, the Swedish artist Hilma af Klint began painting beautiful abstract works in 1906, four years before Kandinsky. Given the many challenges faced by women artists well into the twentieth century, it seems likely that sexism played a role in telling this story.

Apart from any claims of being the first, these three artists and several others in the surrealist and abstract art movements had something in common: Spiritualism. To varying degrees, they

Photo of Georgiana Houghton from her 1882 book *Evenings at Home in Spiritual Séance* (Wikimedia)

believed that what was being expressed on their canvases was not of their invention. They were mere transcriptionists, creating a physical manifestation of the imaginations of other beings or spirits. As a result, the birth of abstract art owes as much to the Spiritualist movement as it does to any individual artist.

Georgiana Houghton

Georgiana Houghton[2] was born in Las Palmas, Gran Canaria, on April 20, 1814, the seventh of ten children (Althaus 2021b). Although her father was a wine and brandy dealer in the Canary Islands, she grew up primarily in London and was educated in France, where she and her sister Zilla studied art. Houghton never married and lived with her parents until their death in the 1860s.

Bereavement often provokes a desire to communicate with the dead, and as a result, the Spiritualist movement experienced peaks of interest after the U.S. Civil War and World War I because so many soldiers did not come home. In Houghton's case, she was particularly moved by the death of her sister in 1851, soon after the birth of her fifth child. Writing in the program to her exhibition, Houghton described her Spiritualist beginnings: "In the summer of 1859 I first heard of the possibility of communion with the Spirits of those who had passed away from the mortal form" (Althaus 2021b, 40). Houghton and her mother attended a séance given by a neighbor, and she had also heard about the psychic experiences of the medium Elizabeth Wilkinson. Soon Houghton and her mother began making their own attempts at communication with the dead.

Elizabeth Wilkinson's husband, William, was the editor of *Spiritualism Magazine* and author of the book *Spirit Drawings* (1858), which described Elizabeth's production of spirit drawings (Hawkins n.d.). William's brother, Garth Wilkinson, was a homeopath and translator of the Swedish mystic philosopher Emanuel Swedenborg (1688–1772), whose philosophy was an important influence on nineteenth-century Spiritualism. William and Elizabeth Wilkinson's eleven-year-old son died in 1856, and in their séances, the Wilkinsons believed that he was speaking through Elizabeth. As described by Wilkinson in *Spirit Drawings*, Elizabeth began to produce drawings and writings, which she maintained had been authored not by her but instead by her dead son.

Following the Wilkinsons' example, Houghton began using a planchette (see Figure 1) to make her own drawings. The planchette was similar to those used today with Ouija boards except that, rather than being used as a pointer, the V-shaped end held a pencil that could be used to draw or write on paper. Houghton petitioned the spirit world to see whether Zilla, a trained artist in life, might guide her hand, but the response that came back assigned a spirit named Henry Lenny, who was described as a deaf and mute artist. Henry very vigorously guided Houghton's hand and even controlled the substitution of pencils of various colors.

Figure 1. Early British Planchette (ca. 1860s) of the type used by Georgiana Houghton to make her spirit drawings. A pencil can be fixed in the hole at the top, and the wheels at the bottom allow free movement. (Wikimedia)

Flower of Samuel Warrand, Georgiana Houghton, 1862. Samuel Warrand was Georgiana Houghton's deceased uncle and her mother's brother. Houghton claimed the drawing had been guided by the spirit of Henry Lenny, who had been a deaf and mute artist in life. Lenny also dictated a long letter explaining the drawing. (Instagram @thecuriousroom)

As was the case for many Spiritualists of the Victorian era, Houghton's mediumship was embedded in a deep religious faith. The clergy did not officially sanction Spiritualism and com-

munication with the dead, but the many Spiritualist newspapers of the period were often explicitly Christian. As described in her 1882 book, *Evenings at Home in Spiritual Séance*, Houghton's séances typically began with a recitation of The Lord's Prayer, and many of her spirit drawings reflected religious themes. The banner photo for this article is titled *The Eye of the Lord*, and in producing it, Houghton's hand was purportedly guided by seven different archangels.

Georgiana Houghton's 1871 art show may not have been a success, but she achieved some prominence in the London spiritualist movement from the 1860s until her death in 1884. In addition to her book about her séances at home, she wrote a second volume about spirit photography titled *Chronicles of the Photographs of Spiritual Beings and Phenomena Invisible to the Material Eye* (1882), which focused primarily on the work of London spirit photographer Frederick Hudson.

Figure 2. A plate from Georgiana Houghton's book on spirit photography showing nine photos taken by the spiritualist photographer Frederick Hudson. Houghton identified picture 4 (second row left) as "Zilla [her deceased sister] standing with her hand in mine." (Author's collection)

Houghton's description of Hudson's photography was entirely praising and credulous, which may be surprising to modern viewers because the photos seem so obviously faked. But in the mid and late nineteenth century, photography was still a new and somewhat mysterious technology. Few people were able to detect double exposures and other forms of manipulation, many of which were easy to accomplish once the photographer retreated to the darkroom to develop the prints. Even naturalist and independent codiscover of natural selection Alfred Russel Wallace, himself a Spiritualist, found many of Hudson's images convincing, though he conceded that Hudson had cheated on occasion "to satisfy everyone" (cited in Fischer 2004).

Hudson did have his critics, both within the Spiritualist community and among skeptics. Competing spirit photographer John Beattie and other critics pointed out several problems. For example, many of the cloaked ghostly figures curiously (if conveniently) had their faces obscured, making it difficult to identify them as the loved one they were alleged to be. In addition, when the cloaked figures or their clothing appeared in front of the sitting subject, as can be seen in pictures 3 and 4 in Figure 2, critics argued that the photographs must have been staged with the complete awareness of everyone involved. The controversy surrounding Hudson was such a point of debate in the London spiritualist community that it split factions into "Hudsonist" and "anti-Hudsonist" camps (Fischer 2004).

After Alfred Russel Wallace wrote two articles supporting the validity of spirit photography, Eleanor Sidgwick of the Society for Psychical Research responded by making her own investigation. She concluded: "After eliminating what might certainly or probably be

Hilma af Klint in her studio circa 1885 (Wikimedia)

attributed to trickery, the remaining evidence was hardly sufficient in amount to establish even a prima facie case for investigation" (cited in Fischer 2004, 34). Thus, the scientific door closed because Hudson and the other spirit photographers had been rejected by a group that was open to the validity of communication with the dead.

Hilma af Klint

The other likely unsung progenitor of abstract art is the Swedish painter Hilda af Klint. Af Klint was born on October 26, 1862, in Karlsberg Castle (Karlsbergs Slott) near Stockholm. Her father taught astronomy, navigation, and general nautical science to naval cadets at the Karlberg Military Academy (Althaus and Voss 2021). Af Klint showed talent in art at an early age and began her art education at the Technical School in Stockholm. The Royal Academy of Fine Arts in Stockholm began admitting women in 1865, much earlier than many European schools, and at the age of twenty she was enrolled.

Af Klint's most important works were created beginning in 1906 under the influence of her study of Spiritualism and Theosophy, the mystical religious movement associated with Russian immigrant Helena Blavatsky. Beginning when she was seventeen years old, af Klint participated in séances and was thought to have skills as a medium. When her sister Hermina died in 1880, af Klint's interest in religion and communication with "the other side" increased.

At a séance in 1904, a spirit named Ananda prophesied that af Klint would paint images on the astral level that would represent the immortality of humanity. During two other séances that year, a spirit named Georg gave af Klint the assignment to make the necessary architectural drawings for a temple, and in 1906 a spirit named Amaliel gave her the task of making the paintings that would become the plans for the temple. This was the origin of a series af Klint undertook between 1906 and 1915 titled "Paintings for the Temple." Most of these works are abstract paintings, and some predate Kandinsky's first abstracts.

Af Klint faced considerable rejection during her life. Her earlier figurative works were better received, but her abstract spiritualist paintings did not easily find an audience. She applied to exhibit her work at the World Conference of Spiritualist Science in London, and initially the leadership turned her down. Only after friends advocated on her behalf did this group agree to display her work at the 1928 congress—the only public display of af Klint's work during her lifetime. Based in part on this experience and her belief that her art would be better understood in the future, af Klint requested that her works not be publicly shown again until twenty years after her death. But she is no longer hidden away in obscurity. In 2018, the Guggenheim Museum in New York City mounted a major exhibition of her work that broke records for attendance (600,000) and for sales of the show catalogue (Ferren 2019).

Hilma af Klint, *The Ten Biggest, No 7*, 1907 (Wikimedia)

Hilma af Klint, *Primordial Chaos*, 1906–1907 (Wikimedia)

A box of Emma Kunz's AION A healing rock powder as it appears on the Amazon.co.uk website. The box illustrates one of Kunz's artworks.

Spiritualism, Psychology, and Modern Art

The connection between Spiritualism and modern art is much bigger than just these two mediums. The Swiss painter Emma Kunz (1892–1963) was also a healer who was believed to have several psychic powers. She claimed her complex geometrical works were records of natural energy flows (Althaus 2021a). In 1942, she visited a quarry and claimed to have discovered strong energy fields and a healing rock that she called AION A. A powder form of AION A is being marketed for the treatment of a variety of ailments on the Emma Kunz website (https://www.emma-kunz.com/en/aion-a/) and on Amazon's UK website; however, AION A was out of stock on the Amazon site when I checked. The Emma Kunz website says AION A can be purchased at Swiss pharmacies and chemist shops.

Wassily Kandinsky himself believed in a kind of spiritualism that played a role in his art. In his book *Concerning the Spiritual in Art*, Kandinsky asserted that colors produce a psychic vibration that can be felt in the human soul (Kandinsky 1977, 24). In addition, some artists of the Surrealist movement, which began in Europe after World War I, employed *automatism* as a means of breaking away from previous traditions. Unlike the religious forms of spiritualism of the nineteenth and early twentieth centuries, the automatism of the surrealists was grounded in Freudian notions of the unconscious. Art critic Fabrice Flahutez suggested artists used automatism to "disorient the mind, disrupt the senses, celebrate the absurd and the accidental" (Flahutez 2021, 240). The Chilean surrealist painter Roberto Matta (1911–2002) said, "The only way to reproduce these psychic landscapes photographically is to automatically translate on the canvas the messages that come from the depths of our minds" (cited in Flahutez 2021, 240). The automatisms of the surrealists were not transcriptions of messages from the spirits of the dead. Instead, automatism was a means of breaking away from the chains of consciousness and the conditioning of civilization.

Antonio Canova: *Psyche Revived by Cupid's Kiss* (1793) at the Louvre (author photo)

Abstract and less representational forms of art began to appear just as photography was becoming a popular way of making images—spirit photography aside—that were remarkably close to reality. This technological development undoubtedly set the occasion for visual artists to break away from traditional forms. For the artists discussed in this article, a common thread is a loss of personal control. Spiritual artists such as Georgia Houghton and Hilma af Klint believed that their physical movements were being controlled by the spirits of the dead. Furthermore, planchettes such as the one used by Houghton move very easily—almost as if you had not touched it—which further breaks down the sense of physical control over its movements. Kandinsky believed he was sensitive to psychic vibrations that came from vari-

ous colors and communicated with the human soul, and the surrealists were tapping into the Freudian unconscious.

Being truly creative and making something entirely new may require breaking away from conventional modes of thought. It is almost a cliché for novelists to claim they don't know what their characters will do next, and E.L. Doctorow is credited with saying, "Writing is like driving at night in the fog. You can only see as far as your headlights, but you can make the whole trip that way." These are all statements that highlight a sense of lack of control during a creative activity, which may be a very effective mindset for these kinds of tasks.

Hilma af Klint and Wassily Kandisky emerged as artists during periods of great upheaval and change. There were threats to traditional religious views; active reform movements, including temperance, abolitionism, and suffrage; and the tragedies of war. This was the crucible that fostered spiritualism and mysticism, which in turn changed the course of the visual arts.

Today, science-minded people understand that the dead do not speak to us, through a planchette or by any other means. Nonetheless we can still appreciate the beauty produced by artists who held these beliefs. From the beginning of human history, art has been inspired by religious beliefs, many of which have been long ago discarded. We do not have to believe in Greek mythology to appreciate the beauty of Antonio Canova's sculpture *Psyche Revived by Cupid's Kiss* (1793). Nor do we have to endorse Spiritualism to recognize the artistic accomplishments of Georgiana Houghton, Hilma af Klint, and Wassily Kandinsky. Indeed, we can go a step further and credit their achievements to them in a way that they did not. ■

Notes

1. For anyone who is interested in Wassily Kandinsky and can get to New York City, there is a major show of his work at the Guggenheim Museum through September 5, 2022.

2. The observant reader will recall that I first wrote about Georgiana Houghton in my column "French Science & Pseudoscience: A Skeptic's Tour of Paris" (Skeptical Inquirer, November/December 2021; https://skepticalinquirer.org/exclusive/french-science-pseudoscience-a-skeptics-tour-of-paris/).

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[SCIENCE AS CULTURE MATTHEW C. NISBET

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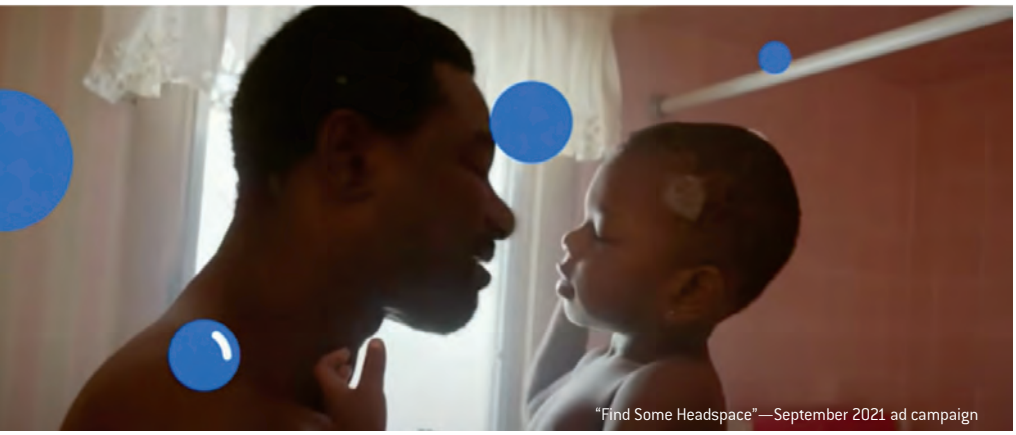
Hooked on Mindfulness: Hidden Design Tricks Make Meditation Apps Addictive



"Find Some Headspace"—September 2021 ad campaign

The pandemic has turned mobile mindfulness into a booming industry, as millions of Americans download meditation apps hoping to boost their attention, mood, and sleep. Major companies concerned about worker productivity have also contracted with app makers to provide their employees with free subscriptions to the services (Lowery 2021).

With the average American meditation app user generating $70 in annual revenue, this year the industry is expected to earn nearly $1 billion in U.S. sales—double what those companies earned prior to the pandemic (Statista n.d). "Once Covid hit, we got a lot of feedback about how hard it was to disconnect from emails because people are constantly home. These apps allow people to disconnect and spend some purposeful moments thinking about, where's my head at?," an executive told CNBC about why his company offers employees a free Headspace app subscription (Levi 2021).

Yet as the author of a recent study concludes, given that people are using their smartphones to access their guided meditations on apps engineered to distract them, it is unlikely that they will experience benefits to mood or attention. Instead, meditation apps most often lead users to "reinterpret their experiences as mindful, even when digital platforms ironically lure them into practices that are distracted and compulsive," writes anthropologist Rebecca Jablonsky (2021).

In other words, meditation apps are likely to be substituting one form of carefully designed behavioral addiction for another.

Merchants of Distraction

In a study published in the journal *Science, Technology, and Human Values*, Jablonsky reports on the eighteen months she spent observing numerous tech industry events, conferences, and meetings. Her research also drew on interviews with seventeen meditation app company managers and designers, visits to two meditation app headquarters, and interviews with twenty-one meditation app users.

Many in the meditation app industry believe that they are "channeling the addictive properties of digital technology toward a healthier form of attention that could restore for users a sense of agency, control, and even personal meaning," writes Jablonsky. In doing so, they are making a bold promise that using their app will "somehow reduce or reverse the negative mental effects of other popular contemporary digital technologies."

When an app company lures new users by way of a carefully targeted social media campaign, the typical offer is free access to a sample video or audio meditation designed to elicit a positive emotion. "Meditation app companies thus capitalize on their knowledge that potential users are already anxious—they are in some form of pain that needs relief—and use this to their advantage by making the first experience of meditation pleasurable and easy," notes Jablonsky.

Among mobile meditation companies, Headspace spends the most on media advertising, sometimes in collaboration with other brands. For example, as part of the "Food for Mood" campaign, Headspace partnered with Whole Foods to offer free guided meditations promoting curated and commodified experiences, such as "Joyful shopping," "Cooking with gratitude," and "Mindful eating."

In September 2021, Headspace launched a YouTube ad campaign[1]

targeting users beyond its U.S.-based market. The ad suggests that the global pandemic is on the wane. Images feature actors wrestling with their children, floating on their backs in the ocean, hugging elderly relatives, and tickling babies.

Testimonials from app users read by actors declare how much meditation has helped them: "This year has been stressful, but then I found Headspace."

Once an individual downloads the meditation app, the app sends a constant stream of notifications intended to promote greater frequency of use and more downloads—which generates more revenue for the company. "The attention designed into meditation apps thus is not the mindful attention that is promised, but rather reflects forms of attention considered more valuable and profitable to the broader technology industry—an attention that is malleable, compulsive, and distracted," Jablonsky writes.

In one interview, a meditation app company executive described its typical user as looking to escape the "fundamental conditions of modern life," an existence that involves millions of demands on their attention. Examples include "people going to bed feeling upset with themselves because of their friend's Instagram accounts" or someone who "can't focus their way through a conversation with their partner because their Apple watch keeps buzzing." According to the executive, meditation apps were the "technological antidote to the problems that technology has created."

Muse CEO Kathryn Minshew tutors TechCrunch's Sarah Buhr on how to use the "attention training" headband and score points on its gamification tablet app. Source: TechCrunch YouTube segment titled "Muse Brain Sensing Headband," September 22, 2014.

In a second interview, a former design director at Muse said that he considered his work a form of "attention activism," because meditations apps are "not just about health and well-being anymore. It's about exercising your right to decide what to pay attention to. It's about resisting those who want to profit from selling something that belongs to you."

His former company's main product is a $300 "brain sensing" meditation headband. According to its Amazon page, the Muse device allows users to discover their "mind-body connection through powerful, accurate real-time feedback on brain activity." By way of just four electroencephalography (EEG) sensors embedded in the headband (a scientific lab uses about forty sensors), the device is supposedly able to notify a user if they have a "busy mind" (signaled by way of "stormy weather" noises) or a "calm" mind ("peaceful weather" noises).

The headband also comes with a "work out plan" that helps the user review their data, set goals, "build a rewarding meditation practice," and "discover incredible insights" into their "inner world." This gamification strategy is intended to promote frequent use of the band by rewarding users with diamond-shaped "Muse points" and bird-themed milestones. "Is this what happens when Angry Birds get therapy? It's fun, but should it be?," mused a *Guardian* journalist after trying out the device (Sammader 2019).

Binging on Mindfulness

Among the twenty-one meditation app users whom Jablonsky interviewed, most "regularly described their broader technology use habits as through the lens of popular critiques of technology 'addiction,' while turning a blind eye to their compulsive use of meditation apps," she writes.

Several users blamed themselves (rather than the app) when their efforts at meditation did not seem to work, concluding that "they needed to be more mindful and pay more attention—reinforcing the value of the meditation app in a circular fashion." One said that using Headspace was similar to her "binge-watching" television habits. She purchased a thirty pack of meditations, binged them quickly, proceeded to try to meditate on her own once a week, and then stopped. If she tried a meditation app again, she expected to repeat the cycle of binging and purging.

Another user recognized that his Calm meditation app could not replicate the likely benefits of in-person meditation classes or therapy sessions, but it was the only option he could fit

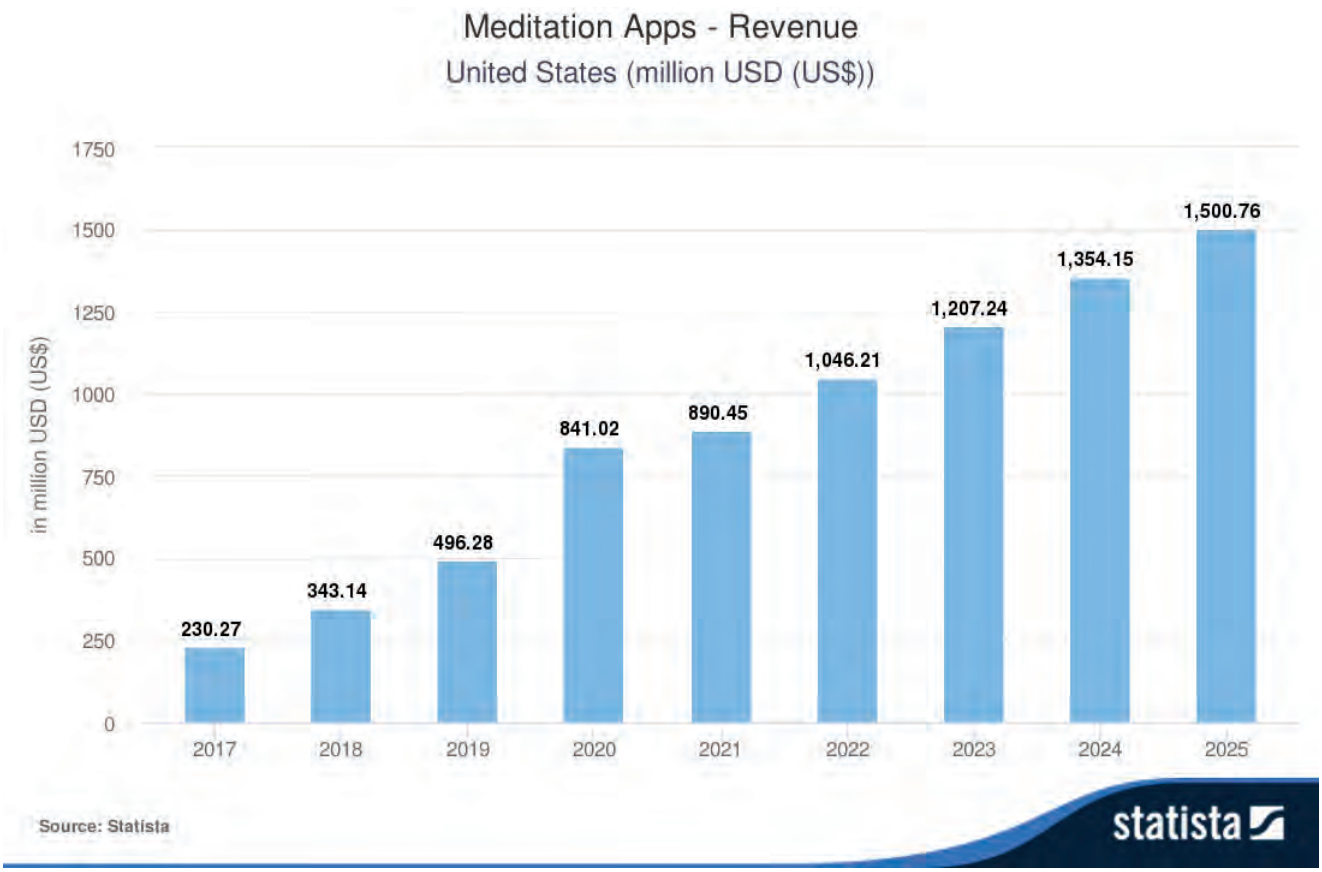


Figure 1: Actual and projected revenue for meditation apps in U.S. market, 2017–2025 (in U.S. millions). Source: Statista n.d.

into his hectic work schedule. "His use of meditation apps thus remains palliative, providing a temporary fix that is interchangeable with other fixes," writes Jablonsky. "He doesn't expect to achieve a state of mindful attention from the meditation app—he simply expects to feel better in the moment."

A third user described using her Headspace meditation app like a podcast, listening to the calming voice of Headspace founder Andy Puddicombe (a former Buddhist monk) while doing chores and writing emails. "The meditation app doesn't absorb her full attention but simply reminds her of the things she would like to pay more attention to when she has the time—notably her own self-care," writes Jablonsky. But this also leaves her stuck in "a state of distraction from which she must recover continuously through efforts to pay attention."

But some interviewees were aware of the traps involved in using mediation apps, optimistically believing that they had the ability to exert control over them. One said she typically used the timer on her device as part of self-guided meditations that she would do in a quiet room. As she told Jablonsky, this allowed her to use the "better tool, which is the real mindfulness—either focusing on your breath or paying attention to your thoughts."

A second user had spent years studying meditation in his native country of India. He described meditation as "building a muscle" and attention as a form of discernment. His experience allowed him to know when he needed to use an app versus something else, and he says he uses an app to meditate twice a day for thirty minutes.

The quest to design an app that facilitates mindful attention is "impossible to fulfill as the affordances of the smartphone and its suite of digital tools capture attention in equal—if not greater—measure as meditation apps claim to give it back," concludes Jablonsky. Meditation apps most often lead users to "reinterpret their experiences as mindful, even when digital platforms ironically lure them into practices that are distracted and compulsive." The meditation app therefore "signals the expanding power of behavioral design, which not only changes how people behave but changes how people think and feel about their behavior," Jablonsky writes. ■

Note

1. https://www.youtube.com/watch?v=x-B8o4iBZAAY

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[THE PRACTICAL SKEPTIC MICK WEST

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Truth Gets Its Boots On

The Beaver Bug 'UFO,' recorded over the foothills of Beaver, Utah, in 2016

An oft-bemoaned reality of the world of skepticism is eloquently expressed in a popular quote attributed to Mark Twain: "A lie can travel halfway around the world before the truth can get its boots on."

It is fitting that this quote both describes what this column is about—the viral nature of falsehood and the difficulty of rebuttals achieving the same visibility—and is also something of an example of such a viral falsehood.

Twain never said that—or at least there is no record of him saying it (O'Toole 2017). Sources that quote Twain claim he said it in 1919, which is rather unlikely because he died in 1910. Of course he *might* well have said it, as versions of the saying have been around since 200 years earlier, when Jonathan Swift wrote:

> As the vilest Writer has his Readers, so the greatest Liar has his Believers; and it often happens, that if a Lie be believ'd only for an Hour, it has done its Work, and there is no farther occasion for it. Falsehood flies, and the Truth comes limping after it; so that when Men come to be undeceived, it is too late; the Jest is over, and the Tale has had its Effect.

This quote rings true today. Swift was talking about the political situation in eighteenth-century London, and yet it encapsulates a timeless problem that skeptics and debunkers are faced with at every turn. How are we to have an effect in spreading truth when falsehoods scorch the earth before we roll out of bed?

I have some ideas, best illustrated with two contrasting examples. First we will begin where the truth was late to the party.

The Beaver Bug UFO

In January 2019, a video suddenly went

viral. It was actually recorded in 2016 when two documentary filmmakers (Sam Chortek and Jimmy Chappie) had been flying their DJI Phantom drone over the foothills of Beaver, Utah, recording some B-roll footage. When they reviewed the footage later that day, they noticed that in two seconds of the footage a white object appears to whizz out of the distance and fly past the camera.

They did some analysis and calculated that the video showed a substantial craft traveling at an impossibly fast speed. They showed it to friends but initially did nothing more with it. Chortek cited "a certain paranoia" about having captured something he was not supposed to see. Chappie felt they might have recorded a secret military drone and was concerned this might lead to trouble.

But 2018 saw the release of three "UFO" videos shot by the U.S. Navy, and the media attention prompted Chortek and Chappie to dig out their footage. Thinking it might be related to the sightings they'd seen several times on mainstream TV, they contacted Brian Hanley, a business analyst and political reporter with a small YouTube channel.

In early 2019, Hanley published the first of about twenty YouTube videos about the Beaver footage. The first was titled "Exclusive, Jaw Dropping UFO Sighting Caught on Camera, New Footage Reveals," which got over a million views. The second was titled "RAW FOOTAGE Finally Released of Exclusive, Jaw Dropping UFO Sighting Near Area 51," and it also racked up over a million views.

Hanley continued publishing videos for several months, many of them with carefully crafted clickbait headlines. There was an "EXCLUSIVE" interview with Chappie, then "Stunning New Analysis," followed by "New Breakthrough Evidence," then "Stunning NEW Enhanced Images."

Interest in an individual case can be cultivated only so far though. While the first two videos had over a million views, the third had just 250,000, and the next few averaged around 100,000. Then it dropped precipitously, with the last few getting less than 5,000 views. But as Swift noted, the brief period of only dubious information had done its work.

The Truth Comes Limping

The astonishing claim that the video showed an incredible flying machine had not gone unanswered. In fact, just four days after the first video was posted there was extensive discussion on my Metabunk website (West et al. 2019). There it was quickly determined that the claims of high speed were dubious at best, and the motion of something much slower, smaller, and close to the camera was a much better fit. One poster, Ivan Horn, calculated a bug-sized object was the best fit and provided a 3D re-creation that matched very well. It seemed pretty much case closed.

The problem was that nobody was reading these explanations. The details were buried in the discussion thread, obscured by a chain of points followed by counterpoints. While quite solid conclusions were reached, they were not in a readily consumable form. They were not videos.

While Metabunk conducted analysis largely via discussion and diagrams, others created their own analysis and made long videos about it. One person in particular, Rob Woodus, created a video that seemed to show that the object *must* have been moving at 4,000 mph. This video had the rather staid title of "2016 Beaver, UT - UFO Video Analysis" but was reposted by Hanley as "Stunning New Analysis."

The videos stuck. Over a million people saw the originals, and maybe half of them saw Woodus's initial analysis. The status of the object as a large hypersonic craft (that somehow nobody noticed at the time) was cemented in UFO mythology. Possibly a few thousand people saw the thread on Metabunk. I made one video that addressed some of the general issues but gave it the rather boring title of "Drone Zip-by UFO Video Recreations" and got a paltry 1,700 views.

Woodus continued to examine the case and eventually realized that a small object was actually a quite viable fit. He went on to visit the location in Utah and saw the amount of stuff (insects and seeds) floating around in the air. In the comments section of his last video on the topic, I asked him what his current thinking was. He replied, "I think it's poplar fluff"—a seed blowing in the wind.

But that video got only 1,600 views. Hundreds of thousands of people had watched Woodus's original videos that "proved" it was a hypersonic craft. But by the time he'd realized it was something like a seed, it was too late; the (inadvertent) jest was over, and the tale had had its effect.

Fighting Flares

On December 4, 2021, a video was uploaded to the UFO reporting database MUFON. That same day someone downloaded it and reuploaded it to YouTube with the title "UFOs filmed from the flight deck over South China Sea?" This was shared on Reddit and quickly found its way to me and Metabunk.

The video is shot from the cockpit of a plane, looking shallowly down at a layer of clouds. The camera zooms in, and we see three diagonal rows of very bright lights that look like they are moving from left to right. The lights almost appear to be spiraling; as the bottom lights fade out, new ones pop into existence. It is, as the cameraman (possibly a pilot) says, "some weird shit!"

I didn't need to solve it myself. It was quickly pointed out on the Reddit thread that the lights looked like flares. One Redditor even found a video that showed flares being deployed at exactly the same angle and rate. So it seemed all we were looking at was three planes, too far away to see in the low-resolution video and low light, that were dropping flares. The parallax from the recording plane's motion gave the illusion of motion. Case closed?

I knew that if I left it at that or just wrote up a post on Metabunk, then it would not be case closed at all. The video was already starting to be reshared by individuals on social media

Video shot from cockpit of an aircraft shows flares released by three other planes.

and clickbait content aggregators. The people who would see it were not going to read some explanation buried in a Reddit thread or even in a neat post on Metabunk. I needed to make a video.

So I wrote a short script, just 220 words, that explained the key points. I got out my teleprompter and recorded myself reading it. I then added the relevant footage, including the compelling comparison with existing flares. I probably spent around three hours on it, and the result was a seventy-second video (West 2021).

I posted it on YouTube as quickly as possible, getting it up the same day the original video was published. Then I posted links to it wherever it was discussed. It quickly gained traction, and I soon saw it being shared by other people in response to social shares. When the inevitable tabloid stories arrived, they often included a link to my video. The viral spread of the video as showing weird alien stuff was, to a degree, tempered.

Practical Skeptical Strategy

Respond quickly. A viral bunk video is like a runaway nuclear reactor. You need to get the cooling rods in there as soon as possible. With the Beaver video, I made an elegant and persuasive little video explaining what was going on. But I made it two years after a million people had seen the first videos and been convinced by faulty analysis. Maybe 1 percent of those people will see my video.

With the flares video, I created the explanatory video just *hours* after the original had been posted. It now lived in the same media space, and the viral growth of the original carried along the explanation, which in turn acted like a cooling rod, slowing down any subsequent spread. Instead of 1 percent, my video got 50 percent of the original's views in the first few days.

Fight fire with fire. Make a video. People who just watched an entertaining video on a topic of interest to them are unlikely to read an article explaining why that video was wrong. But they *might* watch an interesting looking video response.

Keep it short. It's often harder to make a short video than a long one. I could have easily mumbled through a screen-captured analysis for twenty minutes and then dumped it online. Instead, I spent hours to craft just seventy seconds.

A short video has numerous benefits, including that people are more likely to click on it, then they are more likely to watch all of it. They have a far shorter attention span for information that disagrees with their beliefs than for that which agrees with them. Sixty-six percent of viewers watched over 80 percent of this short video. A ten-minute unscripted video on a similar topic fell to 66 percent in the first thirty seconds and had lost half of its viewers by the midpoint.

We cannot always stop a falsehood from going around the world. But if we get our boots on quickly enough, we can travel along and minimize its effect. ■

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[SKEPTICAL INQUIREE BENJAMIN RADFORD

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Investigating the Torquay Ghost Mystery

Q: **Have you heard about the "Buxom Ghost Girl" photo and the mysterious handprints at the Torquay Museum in England? What do you make of that?**

—Daniel M.

A: I first heard about "Britain's Sexiest Ghost" in early 2015 when the latest "spooky" ghost image circulated online. The photo was taken that May at the Torquay Museum in Devon, England, as part of a ghost hunt by a group called Real Investigators of the Paranormal (RIP). It's not clear why they assumed the location would be haunted; Torquay features historical exhibits, artifacts, and life-size dioramas, such as one depicting what life would have been like in an English farmhouse in the 1700s.

The photo appears to be of a blonde woman with her back to a (fake) fireplace set. She appears to be semi-transparent because the whole scene is dark and the shadows are faint, blending into the black background. The figure's lighter, apparently exposed flesh suggests a woman's scoop-neck blouse dark in color. The plunging neckline prompted titillating headlines and jokes. Because the light is coming from in front and below the figure, the neck, chin, cheeks, and forehead are highlighted, though the outlines of a mouth, eyes, and ears are visible.

The sassy tabloid-style moniker aside, it was an ostensibly interesting case. I spent a few hours gathering information about the context behind the photo and, along with a tweet (Figure 1), found a comment from RIP that explained the context:

> We had a Paranormal Experience evening, during which an amazing photo of what appears to be a ghost was taken. We were very excited about the picture, as we were taking photos all over the place, and it wasn't until afterwards when we examined them more closely that we noticed it, which was quite spooky. … It's a pretty clear photograph, and there was no one else present when the photo was taken. So we are at a loss to explain it. … There seems to be no other explanation.

A spokesperson for the museum, Carl Smith, told the local newspaper *Torquay Herald Express* that "It appears to be a woman, and from the angle of the photograph, it looks like she is submerged into the floor, almost like she is below floor level."

Despite virtually no information about the (apparently anonymous) photographer, camera, or much else, the photo itself nevertheless contains important clues. We can see, for example, that no flash was used and therefore there are two sources of light: a red/orange one behind the figure to its left (the faux fireplace) and a white one in front of and below it. Both are faint, soft, and out of focus. Overall, the pattern matches exactly what we'd expect to see if it were a female sitting at a table looking down at her cell phone in the dark.

Adding to the (apparent) mystery, a second supposedly strange thing soon appeared: ghostly fingerprints.[1] In many investigations the (apparent) anomalies multiply, and this was no exception:

> Interest is so high that another paranormal investigation was held on Friday where a new haunting discovery was made: strange handprints inside the coffin of a mummified Egyptian 4-year-old, housed in a different room of the museum. "During the night on the inside of the case, we saw what we believe were handprints on the inside. It was a pretty clear two fingers and a thumb." Smith said. "The case had not been opened for seven years and last time it was opened, it took seven men to open it. It was impossible for it to be opened by someone else." (Moye 2015)

Pressed By the Press

"How could this mystery be solved?," I asked myself as I stroked my chin and adopted a Holmesian expression

of deductive contemplation. Well, the first thing that could be done would be to identify the person who took the photo of the female ghost and (if it's a woman) rule her accidental reflection or image out as a possible explanation for the spirit. I had briefly assumed that such an obvious explanation had already been investigated, but I soon realized that I should not assume that even the most cursory or superficial research had been done by the (perhaps ironically named) "Real Investigators of the Paranormal" group.

I was soon interviewed by David Moye of the *Huffington Post* and asked to comment on what I thought was going on. Even though the investigation was ongoing and my opinions necessarily preliminary, I offered my best analysis. Several aspects of this "mystery" soon became apparent. First, I noted that the claim that "no one else was present" when a ghost photo was taken is a common, and often inaccurate, claim. It is obviously a key detail that is very rarely investigated, much less verified. If that assumption is true, it might give credence to a ghostly explanation. The fact that this photo, like most ghost photos, was identified as strange or mysterious only after the fact is problematic because it means that the key claim that no one else was in the room is an assumption based on *post hoc* recollections. Unless the movements of everyone in the building were carefully monitored—a technically possible but expensive and rarely practical endeavor—we can't be certain who was where and at what time.

Various ghost hunters move all around a location over the course of hours, going in and out of rooms on a whim or wherever curiosity leads them. When we factor in the presence of random staff members, onlookers, members of the public invited to watch, and so on, it becomes clear that the claim is, at best, an optimistic assumption. Had the investigation been done with a modicum of scientific protocols, everyone present would have been assigned to a specific area at specific times and their movements recorded for later comparison. We would also need photographs of everyone present to rule out any accidental contamination or mistaken assumptions. The original photograph file—assuming it's digital—may contain metadata that could reveal the exact time the image was captured, helping narrow down the possibilities. My best guess at the time was that the woman was likely a glass reflection (see Figure 2). I noted that there's a lot of glass in museums (displays, windows, and so on), and the people who took photos were there specifically looking for ghosts, suggesting that confirmation bias may be at play.

Second, I noted there was no clear logical connection between the ghost photo and the fingerprints. I told Moye that I suspected the prints matched the museum's curator or the workers who assembled the display. There were likely identical fingerprints on countless museum display cases not only elsewhere in the Torquay Museum but around the world that were not noticed, much less considered evidence of anything.

Wary of needlessly assuming the burden of proof in this case, I reminded Moye and others who asked that it wasn't up to me, or anyone else, to prove that the image and handprint *wasn't* of a ghost. That would be an impossible task, and in any event, it was the responsibility of those claiming it was mysterious or unexplainable to demonstrate, using argument and evidence, why they believe so.

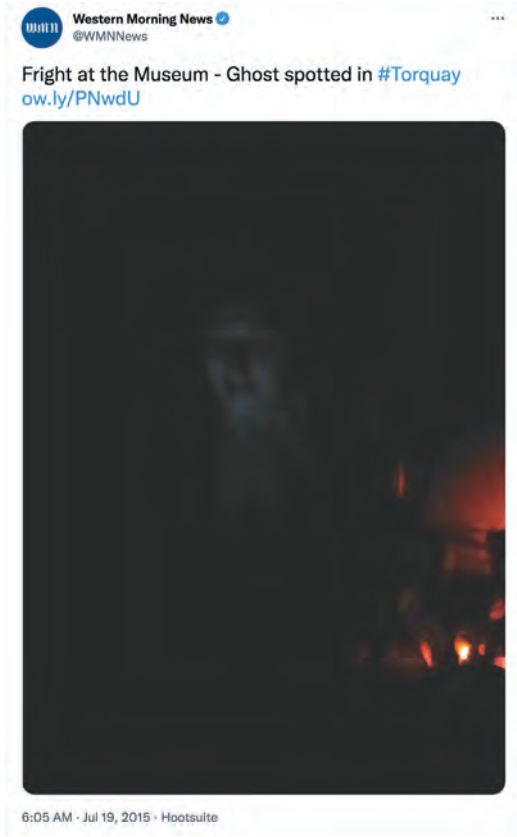

Figure 1. A July 2015 tweet from the *Western Morning News* allegedly depicting a ghost photographed at a museum in Devon, England.

Skeptics on the Case

As I noted, my initial impression was that the image depicted a selfie mirrored in a glass, but upon reflection I decided that's unlikely. As a researcher for a nonprofit educational organization, I certainly didn't have the time or resources to fly to England to investigate the case, but it seemed like the sort of case that would benefit from an onsite investigation. Because the site was a public museum, there were photos available of the interior layout (though not necessarily of the areas and angles most relevant to the circumstances behind this case). I reached out to a colleague, Hayley Stevens, an award-winning skeptical blogger (at https://hayleyisaghost.co.uk) and cohost of the *Spooktator* podcast, and she was game to poke around.

She visited the site, investigated the area, and sent back nearly fifty photos, which we discussed in emails and a video chat. She later wrote up a concise description of her investigation and almost immediately discovered that my—and to be fair, many people's—initial hypothesis was wrong:

> Upon arriving at the museum and venturing onto the top floor where The Old Devon Farmhouse exhibit lives one thing became apparent straight away: The ghost was not caused by a reflection as many had suggested. I found all of the reflective surfaces in the room and took photos of the fireplaces through them from different angles to try and replicate what is seen in the original photo but it wasn't possible. As I inspected the area I saw that there were small benches next to one of the fireplaces that were in the right position for

Figure 2. A photograph of the museum area where the ghost photo was taken, with the author's initial—and ultimately incorrect—guess as to how the image could have been created by a reflection.

> the ghost to have been seated on at the time. Therefore it is my conclusion that Britain's sexiest ghost was actually a living person sitting in the dark next to one of the fireplaces. It almost looks as though her face is lit by the screen of an electronic item such as a camera or phone. (Stevens 2016)

The Ghostly Gal

With new information gleaned from Stevens's onsite investigation, I readily concurred. My best explanation is that this image depicts a female ghost hunter (or member of the public), who got tired and bored after several hours of wandering the Torquay museum in the dark looking in vain for ghosts and decided to sit down at the display table and check her phone or post to social media accounts. While she did that, a second investigator took the photo—knowing perfectly well what was going on and who the subject was—and they both soon continued the ghost hunt. Days later (or months later; it's not clear) when hundreds of photos from that night were reviewed by the ghost hunters looking for evidence, someone noticed this strange image and thought it sufficiently spooky (i.e., ambiguous) that it came to light and was soon making the news.

This is a common—though badly flawed—ghost investigation technique, as I discuss in my book *Investigating Ghosts: The Scientific Search for Spirits*, because evidence should be reviewed at the time so that it can be meaningfully investigated; there is little evidential value in discovering something potentially anomalous long after the event has ended, when all the participants are gone and the environment (including light, temperature, ambient sounds, etc.) has significantly changed.

So, who *is* the gal ghost? We don't know. I suspect that the woman in the photo was either a member of the Real Investigators of the Paranormal team or a friend of someone in the group, and she has chosen to remain tight-lipped about it because she wants to enjoy the notoriety (and because it would raise obvious questions about the group's competence).

Whether the incident was intended as a publicity stunt or it simply turned out that way, the ghost group was wildly successful, with leader Chris Marshall writing in an October 19, 2015, Facebook post:

> There has been a lot of interest in the handprint found at the museum on friday [*sic*] evening if anybody got photos could we get copies of them please. I have had a call from the museum about it and they have received many calls from all over the country and the press. FYI as of this morning the hand print is still visible. (Marshall 2015)

The following day, Marshall noted:

> We are now booked in to present the museums paranormal experience evenings for the next 12 months. The feedback from these evenings has been excellent and they have recieved [*sic*] enquiries from as far afield as London and even Japan. (Marshall 2015)

In the end, the Torquay Ghost was indeed a bust, but the case offers insight into how ghost hunter incompetence (amplified by a sensational and less-than-skeptical media) can create a seemingly spooky ghost photo and how careful onsite investigation can solve the case. As with most ghost photos, the image was not a hoax or prank—or of a ghost—but instead created by a series of mistaken assumptions coupled with mystery mongering and an amateur ghost hunting team with no real desire or incentive to investigate, much less solve, the mystery. ■

Note

1. Fingerprints are created by skin oil (mostly water, fatty acids, amino acids, and triglycerides), which ghosts—being incorporeal after all, and thus dermally challenged—presumably lack. If this is *not* the case and ghosts can in fact leave forensic traces (including sweat, semen, and blood), this could revolutionize ghost investigation, allowing researchers to potentially identify and classify spirits through genetic testing, a scientific approach the Real Investigators of the Paranormal seem to have oddly neglected.

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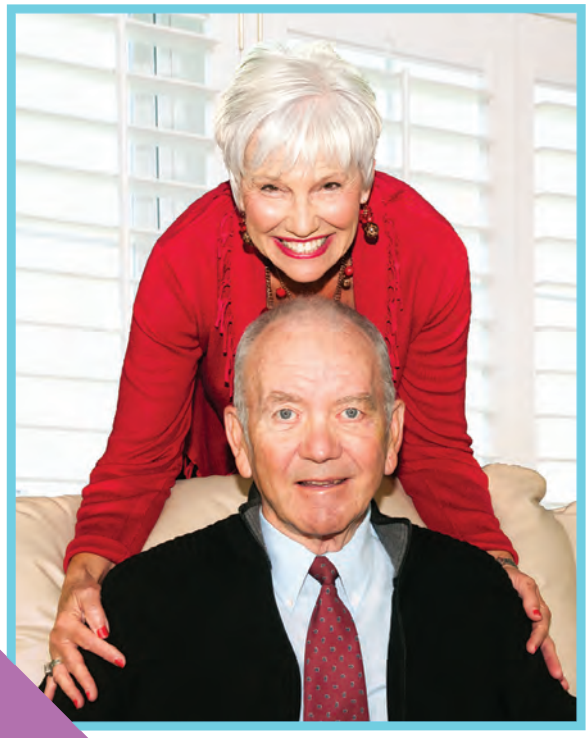

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A Life Preserver for Staying Afloat in a Sea of Misinformation

We are drowning in misinformation and misleading claims. Save yourself with this handy toolkit.

MELANIE TRECEK-KING

My goals as a science educator are to teach students the essential skills of science literacy and critical thinking. Helping them understand the process of science and how to draw reasonable conclusions from the available evidence can empower them to make better decisions and protect them from being fooled or harmed.

Yet while educators agree that these skills are important, the stubborn persistence of pseudoscientific and irrational beliefs demonstrates that we have plenty of room for improvement. To help address this problem, I developed a general-education science course (Trecek-King 2022) that, instead of teaching science as a collection of facts to memorize, teaches students how to evaluate the evidence for claims to determine how we know something and recognize the characteristics of good science by evaluating bad science, pseudoscience, and science denial.

In my experience, science literacy and critical thinking skills are difficult to master. Therefore, it helps to provide students with a structured toolkit to systematically evaluate claims and allow for ample opportunities to practice. In previous semesters, I've had excellent results with James Lett's "A Field Guide to Critical Thinking" (Lett 1990), in which he summarized the scientific method with the acronym FiLCHeRS (Falsifiability, Logic, Comprehensiveness of evidence, Honesty, Replicability, and Sufficiency of evidence).

Logo designed by Wendy Cook

While FiLCHeRS has served my students well, I've found myself adding rules and updating examples to help my students navigate today's misinformation landscape. The result is this guide to evaluating claims, summarized by the (hopefully memorable) acronym FLOATER, which stands for Falsifiability, Logic, Objectivity, Alternative explanations, Tentative conclusions, Evidence, and Replicability.

Think of FLOATER as a life-saving device. By using the seven rules in the toolkit we can protect ourselves from drowning in a sea of bad claims.

The foundation of FLOATER is skepticism. While skepticism has taken on a variety of connotations, from cynicism to denialism, scientific skepticism is simply insisting on evidence before accepting a claim and proportioning the strength of our belief to the strength and quality of the evidence.

Before using this guide, *clearly identify the claim* and define any potentially ambiguous terms. And remember, *the person making the claim bears the burden of proof* and must provide enough positive evidence to establish the claim's truth.

Rule 1: Falsifiability

It must be possible to think of evidence that would prove the claim false. It seems counterintuitive, but the first step in determining if a claim is true is to determine if you can prove it wrong.

Falsifiable claims can be proven false with evidence. If a claim is false, the evidence will disprove it. If it's true, the evidence won't be able to disprove it. Scientific claims must be falsifiable. Indeed, the process of science involves trying to disprove falsifiable claims. If the claim withstands attempts at disproof, we are more justified in tentatively accepting it.

Unfalsifiable claims cannot be proven false with evidence.

They could be true, but because there is no way to use evidence to test the claim, any "evidence" that appears to support the claim is useless. Unfalsifiable claims are essentially immune to evidence. Four types of claims are unfalsifiable:

• **Subjective claims:** Claims based on personal preferences, opinions, values, ethics, morals, feelings, and judgments. For example, I may believe that cats make the best pets and that healthcare is a basic human right, but neither of these beliefs is falsifiable no matter how many facts or pieces of evidence I use to justify them.

• **Supernatural claims:** Claims that invoke entities such as gods and spirits, vague energies and forces, and magical human abilities such as psychic powers. By definition, the supernatural is above and beyond what is natural and observable and therefore isn't falsifiable. This doesn't mean these claims are necessarily false (or true!) but that there is no way to collect evidence to test them. For example, so-called "energy medicine," such as reiki and acupuncture, is based on the claim that illnesses are caused by out-of-balance energy fields that can be adjusted to restore health. However, these energy fields cannot be detected and do not correspond to any known forms of energy.

There are, however, cases where supernatural claims can be falsifiable. First, if a psychic claims to be able to impact the natural world in some way, such as moving/bending objects or reading minds, we can test the psychic's abilities under controlled conditions. And second, claims of supernatural events that leave physical evidence can be tested. For example, young-earth creationists claim that the Grand Canyon was formed during Noah's flood approximately 4,000 years ago. A global flood would leave behind geological evidence, such as massive erosional features and deposits of sediment. Unsurprisingly, the lack of such evidence disproves this claim. However, even if the evidence pointed to a global flood only a few thousand years ago, we still couldn't falsify the claim that a god was the cause.

• **Vague claims:** Claims that are undefined, indefinite, or unclear. Your horoscope for today says, "Today is a good day to dream. Avoid making any important decisions. The energy of the day might bring new people into your life." Because this horoscope uses ambiguous and vague terms, such as *dream*, *important*, and *might*, it doesn't make any specific, measurable predictions. Even more, because it's open to interpretation, you could convince yourself that it matches what happened to you during the day, especially if you spent the day searching for "evidence." Due to legal restrictions, many alternative medicine claims are purposefully vague. For example, a supplement bottle says it "strengthens the immune system" or a chiropractic advertisement claims it "reduces fatigue." While these sweeping claims are essentially meaningless because of their ambiguity, consumers often misinterpret them and wrongly conclude that the products are efficacious.

• ***Ad hoc* excuses:** These entail rationalizing and making excuses to explain away observations that might disprove the claim. While the three types of claims described thus far are inherently unfalsifiable, sometimes we protect false beliefs by finding ways to make them unfalsifiable. We do this by making excuses, moving the goalposts, discounting sources or denying evidence, or proclaiming that it's our "opinion."

For example, a psychic may dismiss an inaccurate reading by proclaiming her energy levels were low, or an acupuncturist might excuse an ineffective treatment by claiming the needles weren't placed properly along the patient's meridians. Conspiracy theorists are masters at immunizing their beliefs against falsification by claiming that supportive evidence was covered up and contradictory evidence was planted.

The rule of falsifiability essentially boils down to this: Evidence matters. And never assume a claim is true because it can't be proven wrong.

Rule 2: Logic

Arguments for the claim must be logical. Arguments consist of a conclusion, or claim, and one or more premises that provide evidence, or support, for the claim. In effect, the conclusion is a belief, and the premises are the reasons we hold that belief. Many arguments also contain hidden premises, or unstated assumptions that are required for the conclusion to be true, and therefore must be identified when evaluating arguments.

There are two types of arguments, which differ in the level of support they provide for the conclusion.

Deductive arguments provide conclusive support for the conclusion. Deductive arguments are valid if the conclusion must follow from the premises, and they are sound if the argument is valid *and* the premises are true. For the conclusion to be considered true, the argument must be both valid and sound. For example: "Cats are mammals. Dmitri is a cat. Therefore, Dmitri is a mammal." The conclusion has to follow from the premises, and the premises are true. Because this argument is both valid and sound, we must accept the conclusion.

In everyday language, the word *valid* generally means true. However, in argumentation, *valid* means the conclusion follows from the premises, regardless of whether the premises are true or not. The following example is valid but unsound: "Cats are trees. Dmitri is a cat. Therefore, Dmitri is a tree." The conclusion is valid because it follows from the premises, but the conclusion is wrong because of an untrue premise; cats aren't trees.

Inductive arguments provide *probable* support for the conclusion. Unlike deductive arguments, in which a conclusion is guaranteed if the argument is both valid and sound, induc-

tive arguments provide only varying degrees of support for a conclusion. Inductive arguments whose premises are true and provide reasonable support are considered to be strong, while those that do not provide reasonable support for the conclusion are weak. For example: "Dmitri is a cat. Dmitri is orange. Therefore, all cats are orange." Even if the premises are true (and they are), a sample size of one does not provide reasonable support to generalize to all cats, making this argument weak.

Logical fallacies are flaws in reasoning that weaken or invalidate an argument. While there are more logical fallacies than can be covered in this guide, some of the more common fallacies include:

• ***Ad hominem***: Attempts to discredit an argument by attacking the source.

• **Appeal to (false) authority**: Claims that something is true based on the position of an assumed authority.

• **Appeal to emotions**: Attempts to persuade with emotions, such as anger, fear, happiness, or pity in place of reason or facts.

• **Appeal to the masses**: Asserts that a claim is true because many people believe it.

• **Appeal to nature**: Argues that something is good or better because it's natural.

• **Appeal to tradition**: Argues that something is good or true because it's been around for a long time.

• **False choice**: Presents only two options when many more likely exist.

• **Hasty generalization**: Draws a broad conclusion based on a small sample size.

• **Mistaking correlation for causation**: Assumes that because events occurred together, there must be a causal connection.

• **Red herring**: Attempts to mislead or distract by referencing irrelevant information.

• **Single cause**: Oversimplifies a complex issue to a single cause.

• **Slippery slope**: Suggests an action will set off a chain of events leading to an extreme, undesirable outcome.

• **Straw man**: Misrepresents someone's argument to make it easier to dismiss.

Consider the following example: "GMO foods are unhealthy because they aren't natural." The conclusion is "GMO foods are unhealthy," and the stated premise is "They aren't natural." This argument has a hidden premise, "Things that aren't natural are unhealthy," which commits the appeal to nature fallacy. We can't assume that something is healthy or unhealthy based on its presumed naturalness. (Arsenic and botulinum are natural, but neither is good for us!) By explicitly stating the hidden premise and recognizing the flaw in reasoning, we see that we should reject this argument.

Rule 3: Objectivity

The evidence for a claim must be evaluated honestly.

Richard Feynman famously said, "The first principle is that you must not fool yourself, and you are the easiest person to fool."

Most of us think we're objective; it's those who disagree with us who are biased, right?

Unfortunately, every single one of us is prone to flawed thinking that can lead us to draw incorrect conclusions. While there are numerous ways we deceive ourselves, three of the most common errors are:

• **Motivated reasoning:** Emotionally biased search for justifications that support what we want to be true.

• **Confirmation bias:** Tendency to search for, favor, and remember information that confirms our beliefs.

• **Overconfidence effect:** Tendency to overestimate our knowledge and/or abilities.

The rule of objectivity is probably the most challenging rule of all, because the human brain's capacity to reason is matched only by its ability to deceive itself. We don't set out to fool ourselves, of course. But our beliefs are important to us; they become part of who we are and bind us to others in our social groups. So when we're faced with evidence that threatens a deeply held belief, especially one that's central to our identity or worldview, we engage in motivated reasoning and confirmation bias to search for evidence that supports the conclusion we want to believe and discount evidence that doesn't. If you're looking for evidence you're right, you will find it. You'll be wrong, but you'll be confident you're right.

Ultimately the rule of objectivity requires us to be honest with ourselves—which is why it's so difficult. The problem is, we're blind to our own biases.

The poster children for violating the rule of objectivity are pseudoscience and science denial, both of which start from a desired conclusion and work backward, cherry-picking evidence to support the belief while ignoring or discounting evidence that doesn't. There are, however, key differences:

• **Pseudoscience** is a collection of beliefs or practices that are portrayed as scientific but aren't. Pseudoscientific beliefs are motivated by the desire to believe something is true, especially if it conforms to an individual's existing beliefs, sense of identity, or even wishful thinking. Because of this, the standard of evidence is very low. Examples of pseudoscience include various forms of alternative medicine, cryptozoology, many New Age beliefs, and the paranormal.

• **Science denial** is the refusal to accept well-established science. Denial is motivated by the desire not to believe a scientific conclusion, often because it conflicts with existing beliefs, personal identity, or vested interests. As such, the standard of evidence is set impossibly high. Examples include denying human-caused climate change, evolution, the safety and efficacy of vaccines, and GMO safety.

In both these cases, believers are so sure they're right, and their desire to protect their cherished beliefs is so strong, they are unable to see the errors in their thinking.

To objectively evaluate evidence for a claim, pay attention to your thinking process. Look at *all* the evidence—even (especially) evidence that contradicts what you want to believe. No denial or rationalization. No cherry-picking or *ad hoc* excuse-making. If the evidence suggests you should change your mind, then that's what you must do.

It also helps to separate your identity from the belief, or evidence that the belief is wrong will feel like a personal attack. And don't play on a team; be the referee. If defending your beliefs is more important to you than understanding reality, you will likely fool yourself.

FLOATER
Thinking Is Power
Evaluate claims with this life-saving toolkit
F
FALSIFIABILITY
It must be possible to think of evidence that would disprove the claim.
L
LOGIC
Arguments for the claim must be logical and not commit fallacies.
O
OBJECTIVITY
Evidence for the claim must be evaluated honestly, without bias or self-deception.
A
ALTERNATIVE EXPLANATIONS
Other ways of explaining the observation must be considered.
T
TENTATIVE CONCLUSIONS
A conclusion can change with new evidence.
E
EVIDENCE
Evidence for a claim must be reliable, comprehensive, and sufficient.
R
REPLICABILITY
Evidence for a claim should be able to be repeated.

Rule 4: Alternative Explanations

Other ways of explaining the observation must be considered. It's human nature to get attached to a single explanation, often because it came from someone we trust or it fits with our existing beliefs. But if the goal is to know the real explanation, we should keep in mind that we might be wrong and consider alternative explanations.

Start by brainstorming other ways to explain your observation. (The more the better!) Ask yourself: What else could be the cause? Could there be more than one cause? Or could it be a coincidence? In short, propose as many (falsifiable) explanations as your creativity allows. Then try to disprove each of the explanations by comprehensively and objectively evaluating the evidence.

Next, determine which of the remaining explanations is the most likely. One helpful tool is Occam's razor, which states that the explanation that requires the fewest new assumptions has the highest probability of being the right one. Basically, identify and evaluate the assumptions needed for each explanation to be correct, keeping in mind that the explanation requiring the fewest assumptions is most likely to be correct and that extraordinary claims require extraordinary evidence. For example, one morning you wake up to find a broken glass on the floor. Naturally, you want to know how it got there! Maybe it was a burglar? Could it have been a ghost? Or maybe it was the cat? You look for other signs that someone was in your house, such as a broken window or missing items; without other evidence, the burglar explanation seems unlikely. The ghost explanation requires a massive new assumption for which we currently don't have proof: the existence of spirits. So while it's possible that a specter was in your house during the night, a ghost breaking the glass seems even less likely than the burglar explanation, because it requires additional, unproven assumptions for which there is no extraordinary evidence. Finally, you look up to see your cat watching you clean shards of glass off the floor and remember seeing him push objects off tables and counters. You don't have definitive proof it was the cat, but it was *probably* the cat.

Rule 5: Tentative Conclusions

In science, any conclusion can change based on new evidence. A popular misconception about science is that it results in proof, but scientific conclusions are always tentative. Each study is a piece of a larger picture that becomes more clear as the pieces are put together. However, because there is always more to learn (more pieces of the puzzle yet to be discovered), science doesn't provide absolute certainty; instead, uncertainty is reduced as evidence accumulates. There's always the possibility that we're wrong, so we have to leave ourselves open to changing our minds with new evidence.

Some scientific conclusions are significantly more robust than others. Explanations that are supported by a vast amount of evidence are called theories. Because the evidence for many theories is so overwhelming, and from many different independent lines of research, they are very unlikely to be overturned—although they may be modified to account for new evidence.

Importantly, this doesn't mean scientific knowledge is untrustworthy. Quite the opposite: science is predicated on the humility of scientists and their willingness and ability to learn. If scientific ideas were set in stone, knowledge couldn't progress.

Part of critical thinking is learning to be comfortable with ambiguity and uncertainty. Evidence matters, and the more and better our evidence, the more justified we are in accepting a claim. But knowledge is not black or white. It's a spectrum with many shades of gray. Because we can never be 100 percent certain, we shouldn't be overly confident!

Therefore, the goal of evaluating claims and explanations isn't to prove them true. Disprove those you can, then tentatively accept those left standing proportional to the evidence available and adjust your confidence accordingly. Be open to changing your mind with new evidence and consider that you might never know for sure.

Rule 6: Evidence

The evidence for a claim must be reliable, comprehensive, and sufficient. Evidence gives us reasons to believe (or not believe) a claim. In general, the more and better the evidence, the more justified we are in accepting a claim. This requires that we assess the quality of the evidence based on the following considerations:

The Evidence Must Be Reliable

Not all evidence is created equal. To determine if the evidence is reliable, we must look at two factors:

• **How the evidence was collected.** A major reason science is so reliable is that it uses a systematic method of collecting and evaluating evidence.

Experts can be wrong, of course, but they're much less likely to be wrong than nonexperts.

However, scientific studies vary in the quality of evidence they provide. Anecdotes and testimonials are the least reliable and are never considered sufficient to establish the truth of a claim. Observational studies collect real-world data and can provide correlational evidence, while controlled studies provide causational evidence. At the top of the hierarchy of evidence are meta-analyses and systematic reviews, as they are a combination of other studies and therefore look at the big picture.

• **The source of the information.** Sources matter; unreliable sources do not provide reliable evidence. In general, the most reliable sources are peer-reviewed journals, because as the name suggests, the information had to be approved by other experts before being published. Reputable science organizations and government institutions are also very reliable. The next most reliable sources are high-quality journalistic outlets that have a track record of accurate reporting. Be skeptical of websites or YouTube channels that are known to publish low-quality information and be very wary of unsourced material on social media. In addition, experts are more reliable than nonexperts, because they have the qualifications, background knowledge, and experience necessary to understand their field's body of evidence. Experts can be wrong, of course, but they're much less likely to be wrong than nonexperts. If the experts have reached consensus, it is the most reliable knowledge.

The Evidence Must Be Comprehensive

Imagine the evidence for a claim is like a puzzle, with each puzzle piece representing a piece of evidence. If we stand back and look at the whole puzzle, or *body of evidence*, we can see how the pieces of evidence fit together and the larger picture they create.

You could, either accidentally or purposefully, cherry-pick any one piece of the puzzle and miss the bigger picture. For example, everything that's alive needs liquid water. The typical person can live for only three or four days without water. In fact, water is so essential to life that, when looking for life outside of Earth, we look for evidence of water. But what if I told you that all serial killers have admitted to drinking water? Or that it's the primary ingredient in many toxic pesticides? Or that drinking too much water can lead to death?

By selectively choosing these facts (or pieces of the puzzle), we can wind up with a distorted, inaccurate view of water's importance for life. So if we want to better understand the true nature of reality, it behooves us to look at all the evidence—including (especially!) evidence that doesn't support

the claim. And be wary of those who use single studies as evidence; they may want to give their position legitimacy, but in science you don't get to pick and choose. You have to look at all the relevant evidence. If independent lines of evidence are in agreement, or what scientists call consilience of evidence, the conclusion is considered very strong.

The Evidence Must Be Sufficient

To establish the truth of a claim, the evidence must be sufficient. Claims made without evidence provide no reason to believe and can be dismissed. In general:

• **Extraordinary claims require extraordinary evidence.** Essentially, the more implausible or unusual the claim, the more evidence that's required to accept it.

• **Claims based on authority are never sufficient.** Expertise matters, of course, but they should provide evidence. "Because I said so," is never enough.

• **Anecdotes are never sufficient.** Personal stories can be very powerful. But they can also be unreliable. People can misperceive their experiences, and, unfortunately, they can also lie.

As an example, let's say you own a company, and Jamie works for you. She is an excellent employee, always on time, and always does great work. One day, Jamie is late for work. If Jamie tells you her car broke down, you most likely will believe her. You have no reason not to—although if you're really strict you may ask for a receipt from the tow truck driver or mechanic. But what if Jamie tells you she's late because she was abducted by aliens? I don't know about you, but my standard of evidence just shot through the roof. That's an extraordinary claim, and she bears the burden of proof. If she tells you that one of the aliens took her to another dimension and forced her to bear offspring but then reversed time to bring her back without physical changes … Again, just speaking for myself, I'm either going to assume she's lying or suggest she see a professional.

Rule 7: Replicability

Evidence for a claim should be able to be repeated. *Replicability* (and its related terms) can refer to a range of definitions, but for the purpose of this guide it means the ability to arrive at a similar conclusion no matter who is doing the research or what methodology they use. The rule of replicability is foundational to the self-correcting nature of science, because it helps to safeguard against coincidence, error, or fraud.

The goal of science is to understand nature, and nature is consistent; therefore, experimental results should be too. But it's also true that science is a human endeavor, and humans are imperfect. This can lead to fraud or error. For example, in 1998, Andrew Wakefield published a study claiming to have found a link between the MMR (measles, mumps, rubella) vaccine and autism. After scientists all over the world tried unsuccessfully to replicate Wakefield's findings—with some studies involving millions of children—it was discovered that Wakefield had forged his data as part of a scheme to profit off a new vaccine. The inability to replicate Wakefield's study highlights the importance of not relying on any single study.

Conversely, we can be significantly more confident in results that are successfully replicated independently with multiple studies. And we can be the most confident in conclusions that are supported by multiple independent lines of evidence, especially those from completely different fields of science. For example, because evidence for the theory of evolution comes from many diverse lines, including anatomical similarities, shared developmental pathways, vestigial structures, imperfect adaptations, DNA and protein similarities, biogeography, fossils, etc., scientists have great confidence in accepting that all living things share a common ancestor.

Conclusion

Using FLOATER's seven rules to evaluate claims can help us make better decisions and protect us from being fooled (or even harmed) by false or misleading claims. Evaluating claims this way will likely take practice. But don't get discouraged; it's worth it! ■

Acknowledgements

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Martian Dreams: 'Unusual Experiences' and Perspectives on Space and Space Aliens

Specific psychological factors are shown to influence thinking about UFOs and space issues in different ways, depending on the scientific or less-scientific basis of that thinking.

MATTHEW J. SHARPS, SIMRAN K. NAGRA, ANDERS PAULSEN, STEVIE MORTENSEN, JASMINE MORENO, AND JANA L. PRICE-SHARPS

In a recent issue of the Skeptical Inquirer, Editor Kendrick Frazier (July/August 2021) noted that UFOs, and the space aliens who putatively drive them, are actually being taken seriously by current mainstream media. This is happening in outlets we would normally expect to showcase scientific thinking rather than UFO promotion and publicity. Paranormal beliefs are beginning to intrude into the serious realm of the sciences, and the psychology of this intrusion may therefore be of considerable importance.

In previous research we published in this magazine, we studied the cognitive effects of psychological influences on paranormal thinking. These influences include dissociation, depression, and tendencies toward attention deficit. In normal people, in the absence of any sort of mental illness, we have found that these factors contribute to a wide variety of paranormal beliefs and perceptions, including Bigfoot and his cronies, the End of the World, and UFOs and their space alien pilots (e.g., Sharps 2012; Sharps 2014; Sharps et al. 2013; Sharps et al. 2014; Sharps et al. 2016; Sharps et al. 2019; Sharps et al. 2020).

But does this research relate to actual *scientific* thinking, more specifically to the gap between the real and the paranormal? In the present research, we have begun to address paranormal and scientific thinking in the same contexts, with reference to what we believe may be an overarching psychological factor in the less scientific realms: the presence of subclinical schizotypy.

Schizotypy is a poorly understood condition, perhaps especially in its subclinical form. As the term suggests, schizotypy lies on a continuum, presumably genetically mediated, with the truly terrible illness of schizophrenia; however, it is by no means the same thing (e.g., Sapolsky 1997). Those with ten-

dencies toward schizotypy may tend to some level of cognitive disorganization, but they also experience introvertive anhedonia, leading them to a lack of pleasure in social interactions. They may therefore tend toward more solitary pursuits and occupations. There may also be a tendency toward impulsive nonconformity, perhaps suggesting limited self-control. These factors tend to show substantial overlap with the behavior of the general population, at least at subclinical levels. However, an additional schizotypal element also merits our attention here: a tendency toward the belief in unusual experiences.

Individuals with this tendency may imbue their own experiences with special, atypical, and potentially unique meaning. Where you see a tree, they may feel an idiosyncratic presence of the tree's spirit. You see a squirrel begging for a peanut; they may see a spiritual if furry "fellow being" who is trying to communicate something, possibly of unique importance to rodent-kind and humankind alike. Everyday experiences, for those with schizotypal tendencies, may cross an ethereal line into an unusual, idiosyncratic universe of occult importance and hidden truth. This is presumably why these tendencies have been repeatedly linked with shamanistic behaviors in many cultures (e.g., McClenon 2012; Sapolsky 1997), although obviously we do not suggest cross-cultural diagnoses, and no value judgments are implied in modern research in the area.

Nevertheless, this linkage makes strong adaptive sense. To quote from one of our earlier SI articles:

> All known human cultures possess beliefs in the paranormal. This may at first seem maladaptive—how could belief in the unreal be sufficiently advantageous that it would have survived the rigors of human evolution in the all-too-real world of past ages? Such beliefs may have yielded evolutionary advantages. Although the interaction of culture and human evolution is complex, it is certainly possible that shared paranormal beliefs within any given culture, such as shared veneration of ancestral spirits or god-kings, might have yielded a coalescent group loyalty that would be useful, militarily and politically, in dealings with other competing cultures. This might very well have resulted in a selective bias toward dissociative processes, leading to military or political success in those cultures which indulge in such beliefs. (Sharps et al. 2016, 40)

The ability to entertain paranormal beliefs may therefore have had adaptive significance in human populations. But how could these considerations apply to the realm of scientific versus paranormal reasoning?

There are beliefs in science that are unproven but that make statistical sense. For example, many professional scientists subscribe, and have for many years (e.g., Sagan 1980), to the concept that life probably exists in outer space. With the vast number of stars that exist in the vast numbers of galaxies in the universe—and with the same physical and chemical principles operating across that universe—the argument for probable extraterrestrial life is easily made on a statistical basis.

However, if your argument is that aliens from the planet Grak are attempting to steal your semen, it is unlikely that you can garner much scientific support for your hypothesis; there is really no question that you have undergone perceived unusual experiences.

So, we suggest that elements of schizotypy, even at the *subclinical* level in perfectly normal people, may be important in different ways for different levels of cognition—the thought processes involved in reasoning at different levels of scientific or unscientific rigor. The research reported here represents an initial attempt to address this hypothesis.

Experimental Framework

One hundred and thirty-four female respondents (mean age 19.16 years, SD = 2.84) and sixty-five male respondents (mean age 19.66 years, SD = 2.56) participated in this study. Respondents completed the Short Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al. 2005). This unique instrument addresses schizotypal tendencies, including such tendencies at the subclinical level, the focus of this research. The instrument consists of forty-three face-valid self-report questions divided into four indices directly related to schizotypal tendencies and beliefs. These scales measure cognitive disorganization (CD); introvertive anhedonia (IA); impulsive nonconformity (IN); and, most important for present purposes, unusual experiences (UE).

O-LIFE scores on the four subscales were compared, by means of linear regression analyses, with Likert (1–7) scales on the five items of what we termed the Space Belief Summary (SBS), where, for each item, 1 indicated total disbelief and 7 indicated total endorsement. The five SBS items were as follows. A brief explanation of each item is also included below.

Item 1. Life exists in outer space. As summarized above, given the statistical realities of the cosmos, this belief is considered highly or entirely defensible by many scientists.

Item 2. Civilizations exist in outer space. This statement requires a bit more belief; the development of civilizations, as we would recognize them, from the building blocks of life would presumably require some level of duplication or parallel development with the psychology and anthropology of Earth. However, this assertion, while less defensible than the first, is still perhaps defensible in terms of what we know of the vast number of stars and planets.

Item 3. The Earth has been visited by extraterrestrial beings. This assertion effectively requires what Kierkegaard called "the leap of enthusiasm" (Kierkegaard [1846] 1940). Cable TV documentaries notwithstanding, there is simply no accepted physical evidence of alien encounters. Enrico Fermi's famous question, "Where is everybody?," may find its answer in the howling uncertainties of the multiple unsolved variables of the Drake equation (e.g., Burchell 2006; Sagan 1980). The universe is very large, the physical distances immense, and the laws of physics enormously discouraging to those who long for travel at warp speed. An additional problem lies in *temporal synchronicity:* One must factor in the remote prospect that a space-faring civilization would have matured to its technological phase during Earth's planetary lifetime, necessarily during the span of human existence to date, and even

more necessarily when we as humans had evolved the cortical power, and developed the technology, to recognize the space aliens in the first place.

This problem is further compounded by the incalculable improbability of the Vulcans or the Klingons finding us way out here at all, far from galactic center on the spiral arm of an average galaxy. One doesn't require a Dark Forest hypothesis, in which all the aliens are hiding from each other, to see the statistical improbabilities inherent in this one. In Eric Hoffer's words in another context entirely (Hoffer [1951] 2010), one needs to be a True Believer to endorse Item 3; does one need subclinical schizotypal tendencies as well?

Item 4. I have seen UFOs. This one is self-evident. Either you think you've seen unidentified objects flying in the sky or you don't, but if you do, you might be expected to consider the experience to be unusual.

Item 5. I have been abducted by extraterrestrials (aliens). Perhaps the ultimate in an unusual experience; to gain additional information, we asked respondents who answered positively to this question to provide us with accounts of the details.

So, in this experiment, we analyzed a continuum of space beliefs, from the rational and easily defended to the wholly idiosyncratic, against an established instrument (the O-LIFE) designed to assess schizotypal tendencies, including those found at the subclinical level (Mason et al. 2005).

Results

Interestingly, although the overall effect of O-LIFE scores was significant on SBS performance (R^2 = .119, F [5,192] = 5.17, p < .001), three of the O-LIFE scales—introvertive anhedonia (IA), impulsive nonconformity (IN), and cognitive disorganization (CD)—had no effect on the results. Apparently one does not need to be cognitively disorganized to have strong beliefs about space and aliens, which may account for the many well-written accounts of the paranormal.

But, consistent with the hypotheses driving this work, the unusual experiences (UE) scale was another matter entirely. Regression analysis demonstrated that the influence of a personal belief in UE was significant on the SBS, p < .001. However, a personal belief in UE, consistent with subclinical schizotypal tendencies, had no influence on responses to Items 1 and 2, dealing with the reasonable statistical supposition that extraterrestrial life exists (Item 1) or even the somewhat more conjectural but still scientifically defensible concept of extraterrestrial civilizations (Item 2).

But regarding Item 3, the idea that space aliens have visited the Earth, the UE scale was highly significant, β = .220, p < .001. As suggested by the considerations discussed above, when a leap of faith was required, as it is in the idea of alien visitations, subclinical schizotypal tendencies were in fact important; however, the only factor that really mattered was the relatively uncritical acceptance of personal, idiosyncratic, *unusual experiences*.

As to personal UFO experiences or alien abduction (Items 4 and 5 of the SBS), we did not have enough respondents endorse either of these concepts for statistical analysis. But even here we learned something: only seven people claimed to have seen a UFO, and all at a very low rating of confidence.

This was a surprise. Unidentified objects are seen flying in the sky all the time, including odd clouds, satellites, misidentified aircraft and birds, etc. Yet only 3.5 percent of our respondents claimed to have seen a UFO, and all reported a Likert level of confidence of only 2 out of 7, suggesting that they weren't at all clear on the experience. This implies something important—more for researchers in the area than for the research per se. This finding indicates that average people, when confronted with the concept of a UFO, may not be considering, generically, the correct idea of a UFO as something in the sky that simply can't be identified. They may be thinking much more specifically and narrowly of starships, Klingons, Grays, and Mr. Spock, the usual subjects when the concept of UFOs comes up in media. This suggests that, in the construction of instruments concerning paranormal "observations" and experiences, researchers may need to be very careful about the language used.

As to UFO abduction (Item 5), only one person endorsed the idea, and at a confidence level of only 4 out of 7. No details were provided.

At least in this single case, we see that a memory of UFO abduction may very well not be very solid. This is perhaps more suggestive of an especially vivid nightmare than a real event. If this type of uncertainty were to prove more widespread than we could possibly infer from a single respondent, we might be better able to explain allegations of UFO abduction. This single case is suggestive, nothing more. Further study here is absolutely required.

However, the overall results of this study were entirely consistent with the original hypothesis: as space beliefs departed from high statistical probability to probability of a low order, at least one characteristic of subclinical schizotypy, represented by the unusual experiences scale of the O-LIFE, emerged as statistically significant. Perhaps theoretically interesting … but is this result of any practical value?

Additional Findings

Along with their responses to the O-LIFE and the SBS, our respondents provided Likert-scale data on the question of whether or not, if humans venture to Mars, they (the respondents) would personally volunteer to live there. The question was phrased in two ways, one of which stated that the Martian colonists would not be able to return to Earth and the other of which did not mention this fact.

These questions may be of considerable practical importance. Obviously, very few people will actually have the opportunity to colonize Mars in the foreseeable future, but there are huge numbers of willing volunteers.

Martian travel would certainly be an amazing experience. However, if one considers the probable realities of life on Mars in crowded spartan accommodations surrounded by airless rocky plains devoid of visible life, one might see the importance of understanding very clearly the motivations of those driven to desire a Martian lifestyle. Those entrusted with planning the sojourns of one-way colonists, pioneers who will live crowded in sealed quarters for life, might be very interested in the psychology involved.

Linear regression analysis was applied to these Martian questions against scores on both the O-LIFE scales and the SBS. Nothing on the O-LIFE was significant on the results, and four out of the five SBS items were not significant either,

including the notorious Item 3 with its emphasis on alien visitors to Earth.

However, SBS scores *were* significant, both on the question of simply living on Mars, $R^2 = .078$, $F(5,191) = 3.21$, $p = .008$, and of living on Mars with no possibility of return, $R^2 = .090$, $F(5, 191) = 3.80$, $p = .003$.

Four out of the five SBS items were irrelevant. The only SBS factor responsible for this significant effect on Martian dreams was endorsement of SBS Item 1, the idea that "Life exists in outer space." Responses to this item were significant on both Mars-colonist questions, *whether or not they could return to Earth* ($\beta = .269$, $p = .009$ and $\beta = .277$, $p = .006$, respectively).

This may be important in a very practical and potentially expensive context. Nothing of subclinical schizotypy was important here; all that mattered was the critical and quite reasonable idea that life exists in outer space. This concept was so important, to those who strongly endorsed it, that they were willing to live on Mars, *even with no hope of return*; no statistically significant difference was observed in responses to the prospect of terrestrial return or its absence.

People who believe in "life in space" want to go to Mars.

But there *is* no life, at least nothing we currently know about, on Mars.

It may very well be that people who want to meet the Vulcans, the Klingons, or other kindred space aliens want to go to Mars. If they make it through the relevant training, they may be transported to a cramped, crowded interior environment, from which they can only venture in space suits—an environment characterized by nothing more lively than static window views of relatively red geology.

For the rest of their lives.

This factor could prove seminally important for personnel issues, in the relatively near future, in the crowded confines of a Mars scientific station wherein an alien-loving true believer is suddenly confronted with the hard realization that the native population of Mars is pretty much a bunch of rocks.

Discussion

In this research, we found that specific schizotypal characteristics, at the subclinical level, had a profound influence on "space" beliefs. Not schizotypal characteristics in general but the characteristics reflected in the unusual experiences subscale alone. A global view of schizotypy at the subclinical level, without the precision of the O-LIFE, would have missed this effect entirely.

Also, this effect did not apply to the scientifically defensible beliefs that life and perhaps civilization exist elsewhere in the universe but only to the "leap of faith" belief that the aliens have come to Earth. This effect was not observed in the reasoning of science; rather, it was only observed in the netherworld of the statistically improbable.

We also saw that the language in which UFOs are discussed may be important for the interpretation of response, and that, admittedly in a single case, the concept of UFO abduction may be very uncertain to the alleged abductee. These very preliminary findings may be of importance for further research but are obviously not conclusive.

However, in a result of potential importance for the future exploration of Mars, we showed that a belief in extraterrestrial life may be very important in the desire to go to Mars, where, as far as we know, there is no life. This is a matter that may have real-world consequences of a very high order. It illustrates the importance of psychological considerations in issues of space and space exploration, as well as in our understanding of cognition in both the scientific and unscientific realms. ■

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Snapshot 'Miracles': Can Photographic Anomalies Be Evidence of the Supernatural?

Two prominent skeptics offer a handy chart to help identify what's really going on in supposedly "miraculous" photographs.

JOE NICKELL AND KENNY BIDDLE

Miracle claims abound, not only at any of various holy shrines but indeed anywhere a religious issue may arise. Here we consider such claims as they apply specifically to photographs and offer a Miracle Photograph Identification Chart (beginning on p. 57).

What Is a Miracle?

Before turning to the subject of miracle photos, we must first consider the meaning of the word *miracle*. In Latin the word is *miraculum*, from *mirari*, "to wonder at." The term has various definitions; dictionaries tend to describe a miracle as something that cannot be explained by the laws of nature.

However, this is most unsatisfactory because it depends not on positive evidence for some event but on its being inexplicable. Such a claim is therefore based on a logical fallacy called arguing from ignorance, that is, from a lack of knowledge. We cannot insist that we don't know what caused something and then conclude that therefore we *do* know it was due to "a miracle from God." One cannot explain one mystery by invoking another.

We have taken a different approach, avoiding putting the proverbial cart before the horse. That is, we have refused to decide, antecedent to inquiry, whether or not a miracle could exist. We thus try to avoid the approach of "believers" and "debunkers" who may start with a desired or expected answer and work backward to the evidence, picking and choosing. We have rather determined, in our work, to investigate specific cases, trying to uncover the best evidence and let it lead to the most likely solution using established principles of scientific inquiry (see Nickell 2013, 13–16).

'Angel' versus 'Spirit'

Not surprisingly perhaps, a supposed "miracle" photograph may have much in common with a "ghost" photo (the subject of a previous joint effort [Nickell and Biddle 2020]). Indeed, because each is essentially defined by the beholder, who gives a name to the anomaly in question (say, "angel" vs. "spirit") or to the context (such as "sacred site" vs. "haunted house"), a photo anomaly in one category may be interpreted differently in another.

It is important to note that the earliest practical photographs—daguerreotypes (from 1839), followed by ambrotypes (beginning in 1855), and the misnamed "tintypes" (from 1856)—failed to record any paranormal entities. Then came glass-plate negatives (about 1859), making double imaging possible, and "ghosts" seemed at last ready to materialize and pose before the camera—if that were possible.

Boston photographer William H. Mumler is credited with the discovery. In recycling his glass plates, he began to notice faint extra images—soon determined to have been caused by the failure to thoroughly clean off the previous images. These yielded dim, ghostlike faces or figures in the resulting photographs. Because Spiritualism had become all the rage, Mumler soon began to advertise himself as a spirit photographer. In 1862, he released what he claimed was "the first true photograph of a soul that has passed over" (Mumler 1862; Nickell 1994; for the photograph, see Manseau 2017, 12). (Another Mumler "spirit" photograph—as an engraving from the May 8, 1869, *Harper's Weekly*—is shown in Figure 1 on p. 57.)

Photographing 'Miracles'

At the end of 1889, George Eastman combined his Kodak camera with the development of celluloid roll film to launch the era of popular snapshot photography (Nickell 1994, 25). Now people were clicking shutters everywhere, and all types of anomalies were beginning to appear in their pictures. If the context was religious, then the anomaly—say a faint figure in a church interior—could be interpreted as, for example, the apparition of a saint.

Such figures may be easily caused accidentally. One way that could occur lies in the long exposure needed for the relatively slow film used for dark interiors. With the camera set on a tripod, the photographer would open the lens, then bide his time elsewhere. If someone should walk in and linger for a bit, maybe saying a prayer at the altar, he is likely to be immortalized by the resulting faint image in the photograph as some holy figure, angel, or spirit (Cohen 1984, 250–251; Nickell 1994, 158; Biddle 2007, 43–53). (See our Figure 2 on p. 58.) Another way that effect may be created is with a sim-

ple double exposure—either accidental or deliberate (Willin 2008, 24–25). (See our Figure 3 on p. 58.)

Most of today's paranormal images are produced by modern filmless or digital cameras that began to be common by the mid-1990s. Some of the standbys in "ghost" photographs that may also be responsible for "miracle" photos are the following: so-called "orbs" (caused by droplets of moisture or specks of dust floating in the air, from which the flash rebounds); orb-like effects known as lens flares; the camera-strap effect (and other rebounding of the flash—from fingers, jewelry, hair, and so on, including mist, frosty breath, and cigarette smoke); and still other effects given in our previous "ghost" chart (Nickell and Biddle 2020).

An especially dramatic "miracle" effect consists of light streaks that tend to look mysterious indeed. Occurring usually at night, the effect is of one or more lines of light that run parallel while tracing a zigzag course. What happens is that multiple *points* of light become *lines* of light due to a *long exposure* and *movement* of the camera. (See Figures 4a and 4b on p. 59.) Again, as with all such effects, including the familiar "orbs" (Figure 5 on p. 59), what distinguishes the "miracle" from the "ghost" effect is the religious context.

'Golden Door' and Other Effects

Just how much the religious setting plays a role is perhaps best illustrated by a particular effect known as the "golden door." It was especially common at religious sites in the 1990s, although (for reasons that will soon become clear) "miracle" photos of this type only happened with the use of a Polaroid OneStep camera (a fact codiscovered by Georgia Skeptics members Dale Heatherington and Anson Kennedy).

The effect is an arched door shape filled with golden light that occurred whenever the snapshot was made with the camera *pointed directly at the sun*—or at any very bright light, such as a halogen lamp. Pilgrims visiting Marian apparition sites brought their OneStep cameras in hopes of photographing the phenomenon, believed by many to be the doorway to heaven mentioned in the Bible (Revelation 4:1). In fact, it is simply a picture of the Polaroid OneStep's own aperture—that is, the doorway into the camera (Nickell 2013, 45, 48). (See Figures 6a and 6b on p. 60.)

Other photographed "miracles" were touted on an episode of *Unsolved Mysteries* that aired October 27, 1995, titled "Kentucky Visions." The show consulted Joe Nickell about the photos, taken at a recent Virgin Mary sighting at a hillside spot in central Kentucky. The photos were taken by a Sunday school teacher who visited the site with eight girls from her class. A producer sent Nickell color photocopies of the pictures to study in advance of the filming. Not surprisingly, one of the photos was of the previously mentioned "golden door," making clear what type of camera had been used—a fact investigators are not always told.

Of the Sunday school teacher's other photographs, two are worth mentioning. One was a phenomenon that was being termed "angel wings." Experimentation proved it was due to light leakage into the Polaroid film pack. Such a pack can be accidentally "riffled" by the thumb on the pack's insertion into the camera, as determined by experimentation. (See experimental photo made by Joe Nickell in Figures 7a and 7b on p. 60.)

The "golden door" effect is simply a picture of the Polaroid OneStep's own aperture—that is, the doorway into the camera.

Experimentation also provided an explanation for the remaining effect, which, apparently, was quite rare. It consisted of a slightly blurry chart superimposed on one picture. At first look, it appeared to have resulted from a double exposure, although a Polaroid OneStep camera should not ordinarily permit that to occur. However, the process of experimentation led to the discovery that a chart was printed on the underside of the topmost card of the film pack (which was meant to protect the pack from light leakage).

A first theory in the experimentation process was that the printed chart had been heavily inked and that that ink had simply offset directly onto the surface of what would be the first photo. However, very careful examination of a successful replication showed that it was not transferred ink but instead a *photo* of the chart.

What actually happened was that—as with the "angel wings"—light had leaked in between the printed card and (in this instance) the first potential photograph. The light then bounced off the white card and onto the light-sensitized surface of the photo-to-be, thus making an exposure of a portion of the chart. In this way, that image was superimposed on the first photograph from that pack—a type of double exposure after all.

Still Other Effects

Among other potential "miracle" effects is the phenomenon of reflections: an image may be reflected by glass or another shiny surface. This represents a simple way for a transparent "extra"—a face or figure—to be transposed into a scene, whether accidentally or deliberately. Some possible/probable examples are given in *The Paranormal Caught on Film* (Willin 2008, 30–31, 72–73, 118–119, 138–139).

An especially important source of images in photos—interpretable as ghosts, angels, or whatever—are perceived pictures called *simulacra*. These offer evidence of the human ability, termed *pareidolia*, to interpret essentially random patterns—such as ink blots or pictures in clouds—as recognizable images. The most famous example is the face of the man in the moon (Nickell 2013, 52).

In photographs, simulacra are typically searched for (by miracle hopefuls) in the random forms of shadow patterns and mottled areas where blotches may be especially interpretable as facial features. Willin (2008, 64) acknowledges the "vast store of possibilities" for simulacra that include "cloud formations, trees, rocks, wood, flower petals," and so on. He

adds, "Religious imagery appears frequently, with the Virgin Mary and Jesus topping the bill, so to speak. As our brains try to make sense of our surroundings it is to be expected that we seek to translate everything we perceive into known images." Successes can mean more "snapshot 'miracles.'"

Hocus-Focus

Finally, we turn from the many accidental effects in photos to various means of deliberately faking an image. Therefore, because "angel" shots are so popular, Willin (2008, 36) urges that we be "very careful with the authenticity" of such photographs.

The same caution should apply to all claimed "ghost" and "miracle" photos. Willin (2007, 127) goes on to say, "In recent years the advent of digital cameras, cameras on mobile phones, the ease of photo-manipulation, and the Internet have vastly proliferated the number of anomalous photographs that crop up, but also make it harder to believe that they are genuine."

There are even "ghost apps" from smartphones as well as various photoshopping techniques that allow one to cause mischief. No doubt there are even possibilities yet to be devised.

* * *

As with our previous treatise on "ghost" photos (Nickell and Biddle 2020), we must note again that such an overview cannot anticipate all possibilities of "miracle" snapshots. Also, we must again observe that with all such "paranormal" pictures we may not know, with any certainty, important aspects of their creation. As these examples should demonstrate, once again, in a given example of some anomaly the least likely explanation is that it represents some supernatural occurrence—if we understand that we live in a real, natural world. ■

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Joe Nickell is CSI's senior research fellow. He is author of *Camera Clues* (1994) and *The Science of Miracles* (2013), among numerous other books.

Kenny Biddle is a skeptical investigator of paranormal claims, an online columnist for Skeptical Inquirer, and author of *Orbs or Dust? A Practical Guide to False-Positive Evidence* (2007).

Miracle Photograph Identification Chart

I. Angels/Holy Figures:

A. Faces appearing in your image

1. Are the facial features (eyes, nose, mouth, etc.) out of place and/or distorted? *Most likely pareidolia (apophenia), an optical illusion.*

2. Are the facial features fuzzy while the body appears normal? *Most likely someone in the scene turned their head during a long exposure. This creates "motion blur" and is common with photos taken in low-light environments without a flash (and occasionally with the flash).*

3. Does the face appear on an interior wall? *Most likely a portrait, painting, etc., hanging on the wall. This could also be a statue placed in an alcove or a stained-glass window in the background.*

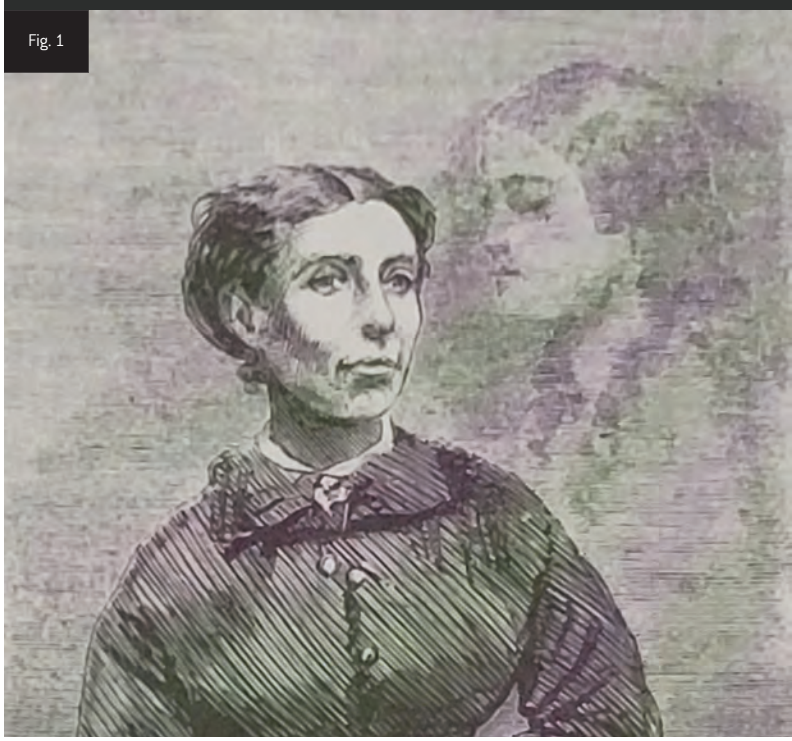
4. Does the face appear on a multicolored and/or textured surface? *Most likely pareidolia (apophenia). Multiple shades of a color, or shadows from a textured surface, can create unusual shadowing, lending to an optical illusion.*

5. Does the face lack color, appearing in black and white? *Likely an unpainted statue on the grounds (seen in background or out a window). Another possibility could be an image inserted by a ghost app from a smartphone. The majority of ghost app "ghosts" are black and white images, which stand out against the background of a color photograph.*

6. Do the faces have soft or sharp edges surrounding them?

a. Plate Photography: *Result of insufficient cleaning of the glass plate from previous portrait exposure. This was a common practice with "spirit photographers," such as*

Fig. 1



William Mumler and Fredrick Hudson.

b. Film: *Likely from a double exposure in which one of the exposures was mostly blacked out, with only the highlighted areas showing through to the final image. Also, a section could have been cut out of another image and rephotographed on top of another, creating a montage image.*

c. Digital: *Likely created from photo editing software or a smartphone app, in which the "ghostly apparition" was digitally cut and pasted to a second image. These "cuts" often retain extra portions of the original image, revealing the editing.*

B. Transparent or shadow figures

1. Was the camera set to a long exposure?

a. Yes: *This is the most common scenario. During a long exposure, another living person entered the frame unaware there was a camera recording the scene. After standing and/or kneeling for a time, the person then left the area. This causes a partial imprint of that person on the film/sensor, something like a double exposure without closing the camera shutter.*

b. No: *Likely a double exposure. See next entry.*

2. Does the photograph appear to have two distinct images merged? *A double exposure is the most likely cause.*

Fig. 2

a. Film: *When two distinct scenes can be viewed on one photograph, it often means the film-advancing mechanism was malfunctioning, allowing a frame of film to be exposed multiple times. On earlier manual cameras, it may have been the operator who forgot to advance the film, causing the same result.*

b. Polaroid: *Likely the film door was not properly closed, or it has a defective roller. This will allow a Polaroid camera to double expose an instant film sheet. In addition, improper handling of the film cartridge can allow light leakage on the first film sheet. Joe Nickell demonstrated this when the text on the back of the black slide (light protector in Polaroid film pack) was imprinted onto the first image of a film pack.*

c. Digital*: During a long exposure, the flash from one or multiple separate cameras will create multiple exposures while using a digital camera. Also, there are various smartphone apps that will create a double exposure with images of your choosing.*

Fig. 3

3. Does the figure appear flat on a wall?

a. *Most likely someone's shadow (yours or another person's) in the path of a camera flash or ambient light source. A light source behind a photographer taking a long exposure photo will create a darker shadow in the final image yet still appear transparent.*

b. *Possibly a shadow cast by a religious icon, such as a statue of the Virgin Mary or a crucifix. Shadows that are not readily apparent can appear darker, and thus more like a figure, when shot during a long exposure. This is usually noticed only when viewing the final image.*

c. *Projection from stained-glass window. When bright light sources (sunlight, flood light, etc.) shine through a stained-glass window that portrays the image of a figure, that image is projected onto other surfaces just like with a movie projector.*

4. Was the photograph shot through a window or plexiglass (e.g., a quiet room in the back of a church or when religious relics are protected within an enclosure)?

a. *Most likely the photographer captured his or her own reflection in the glass/plexiglass or the reflection of a nearby person.*

b. *When not using the flash, due to the obvious reflection, smudges and smears on the glass will stand out more, which can create optical illusions/pareidolia.*

II. Lines of Light

A. Are there multiple lines of light that follow the same pattern?

1. Yes: *Most likely caused by a long exposure that had multiple stationary light sources within the scene. When the camera was moved before the shutter closed (user thinks the photograph is finished), the points of light traced lines of light across the film or sensor. This creates lines of light that follow an almost identical path when the camera is moved slightly (up, down, left, right) but*

Fig. 4a

still pointed toward the scene that was photographed.

2. No, the lines are random: *As above, the likely cause is a long exposure. The difference is that the camera was moved away from the scene originally photographed and is rotated on one or more axes. This allows additional points of light (sources) to enter the camera's view (while the shutter is still open) from any direction, creating random lines of light based on how the camera is moved.*

B. Did the flash fire?

1. Yes: *This often produces a sharp base image. When paired with a long exposure image, this will merge a sharp image of the scene with lines of light created by any light sources (floodlights, street lights, porch lights, etc.). These lines will appear over top of everything else in the scene.*

2. No: *When the flash does not fire, the camera relies entirely on ambient light. Objects will appear fuzzy and/or with a soft glow about them. This is due to camera shake—the movement of the camera when handheld. Light sources directly viewed by the camera will create a line of light, while those not directly viewed by the camera will create a blurred, glowing section in the area the light is illuminating.*

III. Orbs of Light

A. What shape are the orbs?

1. Circle shape

a. Was camera flash used? *Most likely dust particles or bugs near the lens.*

b. Were there lights in the distance (spotlights, display lights)? *Most likely out-of-focus lights.*

c. Does the anomaly appear in the same location area of the photograph in multiple images? *Most likely water stain or dirt on lens or sensor.*

d. Are there reflective surfaces within the scene (e.g., gold, marble, glass)? *Most likely flash (or other light source) reflections.*

2. Hexagon shape

a. Was there a bright light source, such as the sun, overhead lamp, streetlight, etc., in or just outside the frame? *Most likely lens flare. When light rays from a bright light source (such as the sun, flashlight, etc.) reach the front element of a camera lens, they can reflect and bounce off the different lens elements, creating unwanted artifacts in images. Compare shape/number of sides to the shape of your camera's aperture.*

3. Oval shape

a. Was it raining or snowing? *Most likely raindrop or snowflake.*

b. Were you outside? *Possibly an insect in flight.*

c. Was there a bright light source within or just outside the frame, such as a spotlight? *Most likely lens flare.*

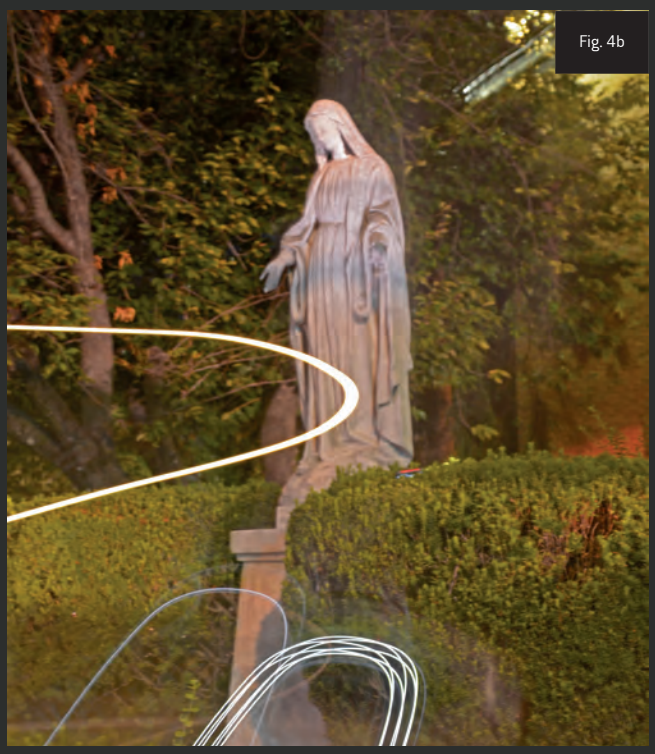


Fig. 4b

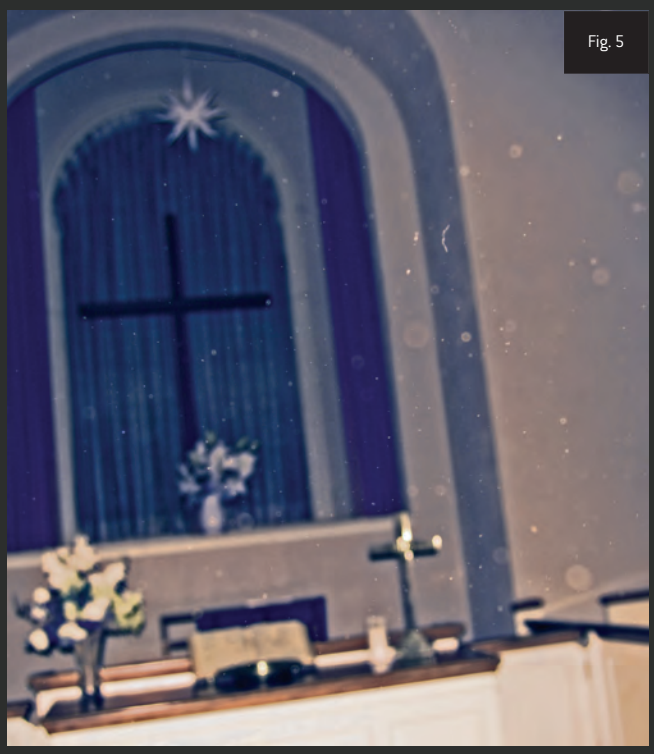


Fig. 5

4. Irregular shape

a. Does the irregular shape appear in the same area on multiple images? *Most likely a foreign object on the camera lens or sensor (i.e., dust, fiber, hair).*

b. Was it moving across a surveillance camera view? *Most likely a bug crawling across the protective lens dome. Most security/surveillance cameras have a weather-proof protective lens, which allows a bug to move across while remaining completely out-of-focus. During low-light situations, a bug will be overexposed by the camera's infrared LED lights that surround the lens.*

IV. Golden Door (Doorway to Heaven)

A. Was a Polaroid camera used?

1. Yes: *A small number of Polaroid OneStep cameras were produced with a rectangular aperture behind the lens. When pointed directly at bright light source, the light was intensified through this specific shape, overexposing this area and imprinting the shape of the aperture onto the instant film. The effect could be achieved by taking photos directly at the sun or even a flashlight pointed at the camera. Check your camera aperture.*

2. No: *Compare the image found on the photograph with your camera's aperture. If it is not a match, recreate the conditions, looking for a method in which the incoming light was intensified into the specific shape of your aperture.*

V. Angel Wings/Light Distortions

A. What type of Camera was used?

1. Polaroid Instant Camera: *Likely caused by improper handling of film cartridge. Placing a thumb on the film pack will depress the spring-loaded pack, including the dark slide (which protects the pack from light exposure). This creates a gap between the film and cartridge, allowing light to enter, partially exposing the film.*

Fig. 6a

Fig. 6b

Fig. 7a

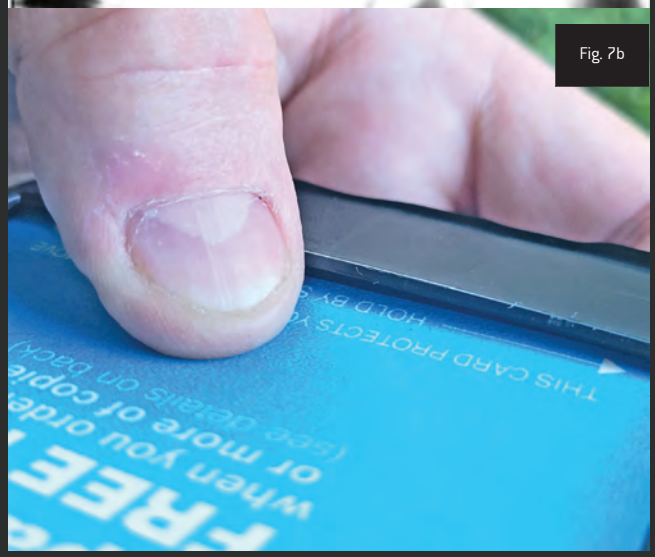


Fig. 7b

2. Film Camera with Plastic Body: *Likely caused by faulty camera cover. When the door covering the film roll is bent/warped or has excessive pressure applied to the back cover while being held or in storage, light can leak inside the camera and partially expose the film roll along the edges. Check the negatives.*

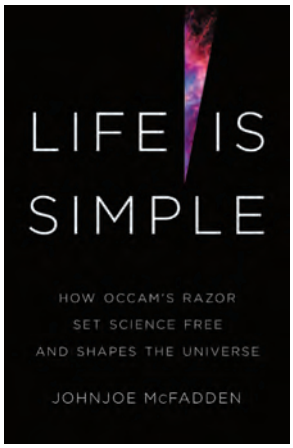
B. Camera Settings

1. Overexposure: *If the wrong exposure setting was used, a low-light environment could expose the background of an image while causing the subject to appear overexposed. In photo example of statues of the Virgin Mary, the statue can appear to be "glowing."*

2. Night Mode: *Many digital cameras (including your smartphone) have a setting specifically for nighttime photography. It often combines the flash with a slightly longer exposure. When taken indoors (e.g., a dark church) or at an outdoor shrine at night, this mode can produce similar lines of light that we see in long exposures (mentioned previously).*

The Man and the Maxim

TERENCE HINES



Life Is Simple: How Occam's Razor Set Science Free and Shapes the Universe. By Johnjoe McFadden. New York, NY: Basic Books, 2021. ISBN 781541620445. 376 pp. Hardcover, $32.00.

William of Occam is a hero of the skeptical movement, and the importance of Occam's razor to skeptical analysis is well known to readers of this magazine. But just who William of Occam actually was and what he actually said is less well known. Johnjoe McFadden's book not only provides a biography of William but a history of the influence his ideas have had since he lived in the fourteenth century. The book is divided into four sections: Discovery (six chapters), The Unlocking (six chapters), Life's Razors (three chapters), and The Cosmic Razor (four chapters).

The first section provides a biography of William and his influences on early philosophy and theology. It will probably contain the most new information about William of Occam for most readers. William led an interesting life! In 1327, he accused the pope of being a heretic—a surefire way to get oneself in serious trouble with the Catholic Church. He was duly summoned to Avignon, then the seat of the Papacy, to answer for this accusation. Things did not go well. In 1328, William fled Avignon and found sanctuary in the Court of Louis IV, the Holy Roman Emperor, in Germany. William never returned to his native England.

William's heresy was to challenge the Church's view that theology was a real science, the "Queen of the Sciences" according to Thomas Aquinas. He attacked the idea proposed by Plato that things we experience in our world are only faint sorts of shadows of the real objects that existed … somewhere. Plato termed these "real" objects *Forms*, and "St. Augustine had already imported Plato's Forms into the early medieval Church where they became ideas in the mind of God" (42). Later, Aristotle modified the Forms into "universals," which were thought to be the "essence" of an object or concept. Thus, "all fathers partook of the essence, or universal, of fatherhood" (42). In William's time, Catholic theology had adopted the idea of universals. But William argued that Forms and universals were not necessary and that "entities should not be multiplied beyond necessity." It was simpler to say that a father was a father because he had children. There was no need for any sort of vague, abstract "entity" of which all fathers took part.

This line of reasoning was a big problem for the Church—but not because of what modern skeptics might think: that there is no need for any gods in the first place. William never went that far. Rather, William's position threatened classic proofs of the existence of God. Aquinas had relied heavily on Aristotle's ideas of universals for his five proofs of God's existence. Now here was William saying that this basic idea of Aristotle was bogus, thereby calling into question Aquinas's proofs. In contrast, William held that God was, more or less by definition, unknowable.

Another major point of conflict between William and the Church was over the nature of human rights, specifically the right to own property. The Church held that Jesus had owned his own purse and transferred ownership of the purse and, by extension, all the world to the Church when he died. This allowed the Church to own vast wealth and to claim dominion over the whole world. Thus, "Pope Alexander VI divided ownership of the New World between the Spanish and Portuguese crowns, based on this notion of divinely appointed domination" (69). William, on the other hand, believed that Jesus did not own a purse and that "natural rights could not be annulled by pope or emperor, even voluntarily, as 'no one can remove the rights and liberties conceded to the faithful by God and nature'" (71). It's easy to see how this position would have been extremely threatening to a vastly wealthy and powerful Church hierarchy. McFadden's discussion of this point made me understand, for the first time, why the seemingly absurd question of whether Jesus did or did not own something was so important at the time.

Sections two through four follow the success of the concept of simplicity through the history of science from William's time to the present. It's a delightful trip with each section describing the relevant problems solved by Occam's razor. As an added bonus, fascinating

tidbits of information are scattered here and there.

The second section covers the development of models of the solar system going, as is well known, from the frighteningly complex to the much simpler modern understanding. McFadden points out that the earlier, more complex models worked pretty well. Furthermore, highly complex models are hard to disprove or falsify because, with so many degrees of freedom, almost any new finding can be incorporated into the model by twiddling with one or more of the variables. This raises the question of "which system, if any, provided a correct physical model of the heavens." Michael Mastlin, under whom Kepler had studied, "had taught him [Kepler] that each was a mere mathematical tool with no claim on the unknowable reality of the heavens. Kepler disagreed" (127). This issue, of how close a model is to reality, even if the model works very well in making predictions, is certainly still with us.

It is in the second section that a most intriguing quote from Copernicus appears. Copernicus is complaining about the complexity of astronomical calculations and says that the "experience was just like someone taking from various places hands, feet, a head, and other pieces [to make] a monster rather than a man" (110). Could Mary Shelley have read this passage?

The third section examines the role of the concept of simplicity in the biological sciences. It begins with the story of Alexander von Humbolt's attempts to collect electric eels in South America for his scientific studies and the question that vexed early scientists: What is life? McFadden notes the position of the biologist Hans Westerhoff that "life is too complex, even 'irreducibly complex' … for Occam's razor to be of any use" (5). In the three chapters in this section, McFadden does an excellent job of refuting this position. By the middle nineteenth century, the use of the razor "had become so much second nature that most scientists were unaware that they were working in that way." Thus, in 1866 Mendel commented that "Experiments with seed characteristics give the results in the simplest and most certain way" (253).

Physics and cosmology are the focus of the final section. There is a discussion of Bayes' Theorem (cleverly referred to as "The Probability Razor") with one of the clearest nonmathematical explanations of this theorem I've read. McFadden has little patience with postmodernists who argue that we can never know anything for certain, saying, "a thousand observations of the sun rising does not provide us with certainty, but it does provide us with the high likelihood that the simplest hypothesis—that it will rise again tomorrow—will turn out to be true" (310).

The final chapter delves into two profound questions to which the author brings to bear the concept of simplicity and the razor. The first is whether our universe is as simple as it could possibly be. This question is difficult to answer; even if the current universe appears, on whatever grounds, to be as simple as possible, that doesn't mean that there couldn't be a simpler one, even if we can't image how that might be. Nonetheless, McFadden invokes the principle of least action (that is, the stationary action principle) to argue that the current universe is pretty close to as simple as can be. This is because from the principle of least action it is possible to derive numerous other fundamental physical laws. These include Newton's laws of motion, "classical conservation laws as well as Noether's theorem and the gauge theories of particle physics. For quantum particles, such as photons, the principle of least action delivers Richard Feynman's path integral method of calculating motion" (317) among other things. Pretty cool! This section ends with a discussion of why, if the universe is simple, there are neutrinos, which seem to have little to do with much of anything.

The second question is why the basic physical constants in our universe are what they are and not different—differences that would not allow life

to evolve or our universe even to exist. Following Lee Smolin, McFadden proposes a "cosmic ecology" in which multiple universes are formed and only some survive to allow life to exist. There are obvious problems here. What is the universe-based equivalent of reproduction? How is the "genetic" information of a universe passed on to succeeding generations of universes? How does this information mutate to create new universes with different values for the physical constants?

The discussion of the evolution of universes is based on the idea of a multiverse in which an infinite, or at least an extremely large, number of universes have existed, exist now, or will exist in the future. It has always struck me that such a hypothesis is extraordinarily unparsimonious. But I suppose if the issue is to minimize the complexity of our little universe and not worry about parsimony elsewhere, it sort of makes sense.

Life is Simple brings the life of William of Occam to light and gives a description of his influence on the theology of his time and his profound influence on science up to the present. It is an excellent book that covers an impressive range of topics. It is well written and exciting in its entirety. ■

Terence Hines is professor of psychology at Pace University and author of *Pseudoscience and the Paranormal*. He is a CSI fellow.

Hollywood Finally Listened to Scientists

MARK BOSLOUGH

Hollywood has always had trouble with science. To its credit, the American Film Institute (AFI) recognized the problem and ran a series of Catalyst Workshops to help scientists learn the art of storytelling and translate their work into film.

In 2009, AFI asked applicants to write essays including sections describing movies they think portray science well and those they think portray it poorly. I chose *Contact* as my good example because the Jodie Foster character Eleanor ("Ellie") Arroway was such a convincing scientist. I noted that she was "intelligent, passionate, skeptical, curious, awed by nature, hardworking, honest, and rarely certain."

Among the many candidates for failure, I chose *The Day After Tomorrow* because "getting scientific details wrong or having physically impossible special effects like explosions in space or flash-freezing oceans is not as harmful to science literacy as the unrecognizable depiction of the process of science and role of scientists."

A 2004 *Nature* article, "Hollywood or Bust," about AFI's workshops highlighted the industry's science problem and the societal need to address it. "In film and television, scientists are often quirky, nerdy, obsessed, reclusive, self-important, and not infrequently mad. These are not character traits that appeal to kids." AFI received funding from the U.S. Air Force to work with scientists to address the possible media effect on the decline of young people entering the sciences.

But science journalist Keay Davidson, whose nonfiction book on tornado research was used by Warner Brothers as an official tie-in for their movie *Twister*, was skeptical. He was embarrassed by *Twister*'s mangling of science and terminology and miffed that the studio bragged about consulting subject matter experts. His advice to scientists: "If Hollywood calls your laboratory, hang up."

Don't Look Up. 2021. Directed by Adam McKay. Starring Jennifer Lawrence and Leonardo DiCaprio.

Sadly, I'd never seen another movie with a scientist character that came close to the authenticity of *Contact*'s Ellie again. Until now. *Don't Look Up* nailed it. There are two reasons for this. First, the producers, writers, and actors respected science and scientists enough to seek out their advice and listen. Second, they called the right scientist, and she didn't hang up.

My friend and colleague Amy Mainzer (professor at University of Arizona) is listed in *Don't Look Up*'s credits as "Astronomy Tech Adviser." It was obvious to me while watching the film that her advice went far beyond astronomy and that she'd schooled the filmmakers on how scientists think and what words they use. It's the first time I'd ever heard a character refer to "peer review" in a film.

Professor Randall Mindy (Leonardo DiCaprio) and his student, PhD candidate Kate Dibiasky (Jennifer Lawrence), each have their own flaws and character arcs but remain within the scope of believable scientists throughout. After they discover that a planet-killer comet is on a collision course with Earth, Professor Mindy's lack of media training and poor communication skills immediately become evident. I found myself screaming, "Don't bury your lede!" when he was telling the president about Gauss's method, astrometric uncertainty, and what he's "trying to articulate." Whoever wrote his lines knows some of my colleagues.

There are nods and parallels to *Dr. Strangelove*: a Slim Pickens–like pilot, a military officer's vending machine issues, a clueless president, a maniacal technocrat, a big explosion, and a flawed escape plan for the powerful—but with a twenty-first-century update that includes social media, inane reality TV,

fake news, and organized populist misinformation.

The comet, of course, is a thinly disguised metaphor for the self-inflicted and potentially catastrophic threat of climate change—a connection that will not be lost on anyone with an iota of scientific awareness. The depictions of self-righteous and comically willful scientific illiteracy were also informed by the past two years of pandemic politicization. The film's commercial success and critical acclaim by science aficionados gives me hope that scientists really can help Hollywood make better films that promote science and improve scientific literacy on subjects that matter: especially climate change.

I asked Mainzer about her role as technical advisor, and here's what she told me:

> I worked on all aspects of the film, especially the dialog. Leo and I had dozens of calls about his main speech alone. Over two years, I had many, many discussions with Adam, Leo, and the rest of the cast about the motivations of the scientists, the tension between them about how to handle the situation, and the importance of the scientific peer review process to solving global challenges. And of course, we had a lot of discussions about asteroid mining and the often-toxic role of billionaires who feel they know better than everyone else.
>
> The fundamental tension between whether it is better to protest the systems of the powerful versus try to influence from within is a big part of the story. My point to Adam and Leo was that, as scientists, we frequently don't have the power to effect the changes that we know need to be made from a technical standpoint to fix a situation. So is it better for us to protest, or try to be the adult in the room with a bunch of people with whom you may profoundly disagree? The worst thing we can do is give up. The future is up to us. That's the great thing about science fiction: it can let us see a possible future and choose a different path.

She concluded, "This movie has been my primal scream therapy for the last two-plus years." The product was healthy scream therapy for the rest of us. ■

Mark Boslough is a physicist who has focused his research and science communication efforts on risks from both planetary impacts and climate change. He is a fellow of the Committee for Skeptical Inquiry. Asteroid 73520 Boslough (2003 MB1) bears his name. He can be found on Twitter @MarkBoslough.

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On *The Exorcist*

As a very serious forty-years-plus scholar of all things related to both the classic novel and film *The Exorcist* (most specifically relating to the writings and work of award-winning novelist and screenwriter William Peter Blatty), I greatly enjoyed your November/December 2021 issue featuring the article "Demoniac: Who Is Roland Doe, the Boy Who Inspired *The Exorcist*?" by JD Sword.

In his impressively researched article in which Mr. Sword ends with his comment, "Should a reboot of *The Exorcist* follow the 'chilling true story?' My answer is 'No,' because the true story is neither chilling nor likely true," I was sadly disappointed that he never once mentioned Blatty's own personal nonfiction account of the entire subject in his book *William Peter Blatty on* The Exorcist*: From Novel to Film*, published by Bantam in 1974. I highly recommend Mr. Sword seek it out to get what is still, in my opinion, the final word on the entire subject.

I would also like to kindly point out one discrepancy in the photo that appears on page 45, captioned "Linda Blair played a possessed girl in 1973's *The Exorcist*." The photo is not of actress Linda Blair; in fact, it's not even an actual person but rather Special Effects Artist Marcel Vercoutere's highly realistic animatronic figure used for the "spinning head" sequences in the film. The swivel seam is clearly visible right below the jaw line.

Kevin Fellman
Phoenix, Arizona

JD Sword replies:

I am familiar with William Peter Blatty on *The Exorcist*: From Novel to Film*, although I confess, I have not read it. I discussed Blatty's own account of how he obtained the case study, which is contained in the book, on my podcast,* The Devil in the Details*. Unfortunately, I simply didn't have the space in the article to go into that amount of detail.*

I respectfully disagree with Mr. Fellman regarding the "final word on the entire subject." Unless there's a remarkable piece of evidence in William Peter Blatty on *The Exorcist*: From Novel to Film*, a smoking gun that no other source seems to mention, there's simply no good reason to believe that Ronald Hunkeler was possessed. The evidence just isn't there. Furthermore, since the article ran in* Skeptical Inquirer*, a "29-year-old companion" of Ronald Hunkeler came forward and revealed to the* New York Post *"He said he wasn't possessed, it was all concocted. He said 'I was just a bad boy.'"*

I would say that *is the final word on the subject.*

Your article on the real-life *Exorcist* boy mentioned Father Walter Halloran, one of the Jesuits who performed the ritual (November/December 2021). As a Campion student in 1960–1962, I served mass for Halloran and had him as a teacher. He was a typical Jesuit: highly intelligent and knowledgeable in worldly subjects but also a strong believer in far-fetched Catholic doctrines. We nicknamed him "Batman" for the cape that he wore in the Mississippi Valley fog. We students were unaware of the exorcism, which had occurred years earlier.

When Halloran was interviewed in a documentary about the exorcism, he convincingly reported anomalous events—such as objects inexplicably flying through the air and writing that appeared on the boy's chest—but did not offer any conclusions about them or about the entire matter.

The exorcism was not the most interesting part of Halloran's life. He was a handsome, reputedly rich "man's man," an athlete, and a coach. Wikipedia tells how, in his forties, Halloran enlisted in the U.S. Army to serve the troops in Vietnam. Forced to become an officer, he volunteered for and passed the grueling paratrooper training usually taken by nineteen year olds. In Vietnam, he spent so much time on helicopters going to minister as a chaplain to the troops that his superiors had to order him to take breaks. He was an extraordinary person.

George M. Reardon
Houston, Texas

Evolution Acceptance

It is of course a bit of good news that the recent poll reported by Glenn Branch now shows a U.S. acceptance of evolution above 50 percent (News & Comment, November/December 2021). I am however troubled that this poll question has consistently used the word *developed* in place of the word *evolved*. Technically, *development* is what happens between the time an egg is fertilized and the time the animal is born or hatched. This is obviously not the same thing as organic evolution.

This mistake is often made when bacteria are said to have *developed* resistance to antibiotics—no they did not, they *evolved* resistance to antibiotics. I would also point out that even if the "E-word" were used, there are many in the intelligent design community who would agree with the statement because they do believe in evolution by "supernatural selection" rather than by natural selection, so they are in no way in agreement with the scientific community in their views on evolution. So while this news is certainly good, there could be complications not revealed by the results on this one simple statement.

David Zeigler
Wimberley, Texas

Piltdown Hoaxer

Matthew C. Nisbet's Piltdown Hoax article (November/December 2021) was engaging, but it may give the impression that de Groote and her collaborators were the first to conclude that Dawson was the lone perpetrator of the fraud. In reality, Joe Weine already came to that conclusion in his 1955 book *The Piltdown Forgery*.

Using the evidence and techniques available at that time, he determined that the only plausible conclusion was that Dawson was the perpetrator. De Groote et al. have only confirmed his finding by updating it with more modern techniques.

Don Martin
Toronto, Ontario
Canada

Piltdown Painting

I hope this letter will elicit a sigh of thanks from those of your attentive readers who (like me) were bewildered by the painting and caption that accompanied "The Piltdown Hoax Revisited" column. John Cooke is the *artist* of this painting, not the man in the white coat examining the Piltdown skull. The man in the white coat is Arthur Keith. Sir Ray Lankester, mentioned in the caption, does *not* appear in this illustration, although his right hand can be glimpsed on the tabletop at the far right. Other than that, Sir Ray (who does appear front row right in the original painting) has been cropped out.

Maxwell E. Siegel
Kennett Square,
Pennsylvania

Homeopathy Volume?

In "A Design for a Definitive Experiment to Test Homeopathy" (November/December 2021), Richard Dawkins cites James Randi's statement that a C30 homeopathic concentration would require a volume equal to that of the solar system to contain one molecule. I have done this exercise from time to time, with a much different volume, as follows:

If the solar system's radius is 4.5 to 144 billion km, depending on which outer limit is chosen, its disk area is 6.4×10^{19} to 6.5×10^{22} km^2. If the solar system's thickness is 92.5 to 286 million km, depending on limits chosen, its volume would be about 5.9×10^{27} to 1.9×10^{31} km^3. Choosing conservatively takes the value 5.9×10^{27} km^3. It's true that this calculation is rough, but the great differences in volumes, and the conservative choice, make high accuracy less of a concern.

Avogadro's Number, 6.022×10^{23} molecules per mole, represents the number of molecules in a 1-molar solution. A homeopathic C30 concentration, with 1×10^{-60} moles, would therefore contain 6.022×10^{-37} molecules per liter. A liter is 1×10^{-12} km^3, so a 1×10^{-60} molar solution would have 6.022×10^{-25} molecules per km^3, that is, 1.67×10^{24} km^3 per molecule. A spherical volume this big has a radius of 7.36×10^7 km. For reference, the orbits of Mercury and Venus have average radii of 4.95×10^7 and 1.08×10^8 km, respectively.

It is obvious that the C30 volume of 1.67×10^{24} km^3 is very much smaller than a conservative solar system volume of 5.9×10^{27} km^3.

Of course, either volume solidly makes the point against homeopathy.

Joan MacNeill
Portland, Oregon

Overpopulation

It was refreshing to find, in your November/December 2021 issue, three letters openly discussing the taboo topic of world overpopulation. I have puzzled over the generalized silence in the media on this issue—the root cause of climate change, environmental degradation, and now zoonotic pandemics. The religious Right argues that their deity wants more babies. The fringe Left argues that providing contraceptives to the third world is cultural genocide. People who understand the crisis avoid the issue for fear of offending someone. In fact, unrestrained procreation is a basic evolved instinct in all organisms. I would hope that we would not continue to multiply mindlessly in our petri dish until all the medium is consumed and we go extinct.

The solution is evident. The experiment has already been run in industrialized secular democracies. Enforced restrictions on fertility are unnecessary, as well as impossible. Education, opportunity, and access to contraception, as outlined in Marian Starkey's letter, automatically result in birthrates declining to sustainable levels.

Peter Wyble
Chicago, Illinois

Nuclear Energy Has Advanced

I'm not sure that the John Orr letter taking issue with the content of the earlier Fukushima article was properly answered (Letters, November/December 2021). As I see it, the biggest problem is with the word *nuclear* and using it to describe a much smaller and more primitive class of technologies than is consistent with reality. A similar problem with language exists with the term *steam power*. The earliest use of steam as a propellant or power source that we currently know about was documented by Hero of Alexandria in the first century of the current era. The first somewhat efficient use of steam is generally attributed to several inventers in both the Islamic and European areas in the sixteenth and seventeenth centuries. Yet even those bear almost no resemblance to the technologies that powered ships, locomotives, and electrical power plants in the first half of the twentieth century. To class them together is meaningless, other than to say that steam was present in all their cycles, *someplace*. The variances in technologies for tapping the power of nuclear fission and fusion are quite dramatically greater than what we have thus far used for steam.

Both the TerraPower and GE Hitachi projects promise to produce power with near zero contaminated waste byproducts. And both use mechanical systems that would not be at risk from catastrophic disturbances such as tidal waves, externally powered explosions, or whatever. While it is obviously a good thing to not set aside our SI approach—which demands adequate supporting evidence—it is equally important that we not be blinded to the possible by what we think we know about radically different and significantly more primitive progenitor technical approaches. That would be comparable to evaluating the feasibility of modern aviation by looking only at pre-WWI aircraft.

It would take several decades before many others could see the same things that aviation pioneer Glenn Martin did very early on, and it would take a lot of engineering and investments in early designs before the public would come to trust the airplane as a safe and reliable way to get around. That nuclear energy would face similar challenges of development and trust is neither surprising nor bad. And as is the case with aviation, we should never let down our guard and become too complacent about its safety. But just because the primitive is not yet refined, we should not assert that it should not be pursued.

Skepticism is warranted. Declaring nuclear power too fraught with challenges to pursue is being blind to the need and the opportunity.

Craig Dupler
Lopez Island, Washington

For the Record

In "The Psychology of Vaccine Hesitancy" (November/December 2021) on page 56, the end date for World War I should of course have been given as 1918, not 1914.

[FEEDBACK

The letters column is a forum on matters raised in previous issues.

Letters should be no longer than 225 words.

Due to the volume of letters we receive, not all can be published. Send letters as email text (not attachments) to letters@skepticalinquirer.org. In the subject line, provide your surname and informative identification, e.g.: "Smith Letter on Jones evolution article." Include your name and address at the end of the letter. You may also mail your letter to the editor to 944 Deer Dr. NE, Albuquerque, NM 87122.

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